internal displacement monitoring centre

DISASTER-RELATED DISPLACEMENT RISK: MEASURING THE RISK AND ADDRESSING ITS DRIVERS

REPORT

This report was written by Justin Ginnetti based on research and analysis co-produced by Chris Lavell and Travis Franck
March 2015

DISASTERS CLIMATE CHANGE AND DISPLACEMENT

EVIDENCE FOR ACTION

PARTNERS

THE NANSEN INITIATIVE
DISASTER-INDUCED CROSS-BORDER DISPLACEMENT

NRC NORWEGIAN REFUGEE COUNCIL

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TABLE OF CONTENTS

ACRONYMS 6
PREFACE 7
EXECUTIVE SUMMARY 8

1. INTRODUCTION: KEY CONCEPTS RELATED TO DISPLACEMENT RISK 10
   - 1.1 What is risk? 10
   - 1.2 Risk in the context of disasters 10
   - 1.3 Components of disaster risk 12
   - 1.4 Displacement in the context of disasters and disaster risk 14
   - 1.5 Measuring disaster and displacement risk 16

2. MEASURING RISK: WHO IS AT RISK? WHERE ARE THEY LOCATED? 18
   - 2.1 Measuring historic displacement and future displacement risk 18
   - 2.2 Historic displacement 18
     - 2.2.1 Average historic displacement estimates 18
     - 2.2.2 Distribution of events by size and frequency of occurrance 20
     - 2.2.3 Demographic distribution of historic displacement risk 20
     - 2.2.4 Geographic distribution of historic displacement risk 21
   - 2.3 Future displacement risk 23
     - 2.3.1 Disaster Displacement Risk Index (DDRI) 23
   - 2.4 Displacement risk related to droughts and floods in the Horn of Africa 25

3. IDENTIFYING AND ADDRESSING THE DRIVERS OF DISPLACEMENT RISK 27
   - 3.1 Hazards: Climate change is a future risk driver that remains poorly understood 27
   - 3.2 Exposure: More people in harm's way 28
   - 3.3 Exposure: Rapid urban growth and poor urban planning 29
   - 3.4 Vulnerability: Unequal distribution of vulnerability and risk governance capacities 31
   - 3.5 Vulnerability: Conflict makes people more vulnerable 33

4. CONCLUSION 36
   - 4.1 Coordinate policy frameworks at multiple scales 36
   - 4.2 Address evidence and knowledge gaps to inform DRR, development and climate change adaptation plans 37

ANNEX: METHODOLOGY 38

ACRONYMS

AAL	Average Annual Loss
CAPRA	Probabilistic Risk Assessment Initiative (of ERN-AL)
CCA	Climate Change Adaptation
CRED	Centre for Research on the Epidemiology of Disasters
DARA	Development Assistance Research Associates
DESINVENTAR	Disaster Inventory Management System
DiDD	Disaster-induced Displacement Database (of IDMC)
DDRI	Disaster Displacement Risk Index (of IDMC)
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EM-DAT	Emergency Events Database (of CRED)
ERN-AL	Evaluación de Riesgos Naturales–América Latina
GAR	*Global Assessment Report* (of UNISDR)
GFDRR	Global Facility for Disaster Reduction and Recovery
GRID	Global Resource Information Database (of UNEP)
HFA	*Hyogo Framework for Action*
ICCRR	Indicator of Conditions and Capacities for Risk Reduction
IDNDR	International Decade of Natural Disaster Reduction
IDMC	Internal Displacement Monitoring Centre
IPCC	Intergovernmental Panel on Climate Change
IRR	Indicator of Conditions and Capacities for Risk Reduction (of DARA)
PML	Probable Maximum Loss
PREVIEW	UNEP/GRID Project for Risk Evaluation, Information and Early Warning (Commonly known as 'Global Risk Data Platform')
UNEP	United Nations Environment Programme
UNISDR	United Nations Office for Disaster Risk Reduction (formerly the International Strategy for Disaster Reduction)
UN OCHA	United Nations Office for the Coordination of Humanitarian Affairs
WCDRR	World Conference on Disaster Risk Reduction

PREFACE

From 14 – 18 March 2015, United Nations' Member States will meet in Sendai, Japan, to finalise a new global agreement to reduce disaster risks. This World Conference on Disaster Risk Reduction (WCDRR) will start four years and four days after the Great Tōhoku Earthquake and Tsunami ravaged this densely inhabited coastal prefecture and triggered one of the largest nuclear disasters in history.

The WCDRR marks the second occasion in which the world's governments will have met in Japan on the anniversary of a major disaster to adopt a plan to reduce disaster risks. In 2005, ten years after the Kobe Earthquake, they convened in Kobe, Hyogo Prefecture, where they agreed to the *Hyogo Framework for Action (HFA) 2005-2015: Building the Resilience of Nations and Communities to Disasters.*

The HFA did not address the risk of being displaced by a disaster, nor did it outline specific measures to reduce this risk or to improve the disaster response for those who had been displaced. Since the HFA was adopted, this risk has been more widely recognised and there is now an increased will to address it. During the preparatory process leading up to the WCDRR, the UN, governments, researchers and civil society organisations have all stressed the need to consider disaster-related displacement in the HFA's successor agreement.

The purpose of this report is to consolidate the best available evidence about disaster-related displacement risk, including its magnitude and its drivers. It builds upon data and findings from IDMC's *Global Estimates* reports as well as five regional analyses of displacement risk which were produced in support of the Nansen Initiative – a state-led process that brings together representatives from governments, international organisations, civil society, think tanks and other key actors to develop a protection agenda for people displaced across state borders by disasters and the effects of climate change.

Looking beyond the WCDRR in March, this report is aimed at a broad array of stakeholders that will consider the issue of disaster- and climate change-induced displacement in different policy forums later in 2015. These include the United Nations Framework Convention on Climate Change, the Sustainable Development Goals, the Nansen Initiative's global consultation as well as the preparation for the World Humanitarian Summit in 2016.

EXECUTIVE SUMMARY

This report applies the concept of risk to disaster-related displacement and **quantifies human displacement risk around the world. It brings together data from several sources – notably the *Global Assessment Reports* (GARs), international and national disaster loss databases (EM-DAT and DesInventar) and the Internal Displacement Monitoring Centre's (IDMC)** *Global Estimates* and Disaster-induced Displacement Database (DiDD).

Applying the concept of risk to disasters and displacement

This study reflects an awareness of the need to see disasters as primarily social, rather than natural, phenomena. This view acknowledges the fact that humans can act and take decisions to reduce the likelihood of a disaster occurring or, at the very least, to reduce their impacts and the levels of loss and damage associated with them. Disasters are thus no longer being perceived as 'natural' or 'acts of God' but instead as something over which humans exert influence and can therefore prevent.

This reconceptualisation of disasters signifies a shift from a retrospective, post-disaster approach to an anticipatory way of thinking about and confronting disasters. This conceptual development was reflected in a public policy objective: disaster risk reduction (DRR). Strengthening DRR became a global priority in the 1990s, the United Nations' International Decade of Natural Disaster Reduction. Following the 2004 Indian Ocean Tsunami, UN Member States adopted the 2005 Hyogo Framework for Action (HFA), a ten-year plan endorsed by the UN General Assembly which aims to reduce the risk of disasters globally. The objectives codified in the HFA will be renewed at a global conference in March 2015 in Sendai, Japan, at which Member States will reaffirm their commitment to DRR. One important outcome of the HFA process is awareness that without the ability to measure disaster risk it is not possible to know if it has been reduced.

In the context of disasters, displacement includes all forced population movements resulting from the immediate threat or actual impacts of a disaster situation regardless of the length of time displaced, distance moved from place of origin and subsequent patterns of movement, including back in the place of origin or re-settlement elsewhere. Based upon existing information, and notwithstanding some notable exceptions, the vast majority of people displaced by disasters are assumed to remain within their country of residence, rather than to cross internationally recognised borders to find refuge.

Displacement is a disaster impact that is determined by the underlying vulnerability of people who are exposed to shocks or stresses. It is this combination of vulnerability and exposure to hazards that compels them to leave their homes and livelihoods just to survive. While this report focuses on the human displacement component of disasters, this is a somewhat artificial distinction – the displacement is one of several factors that combined to transform a hazard event into a disaster.

Key findings

Displacement risk trends:

- Disaster-related displacement risk has quadrupled since the 1970s.
- Displacement risk has increased at twice the rate of population growth, meaning that people are twice as likely to be displaced now than they were in the 1970s.
- The number of mega-events that displace more than 3 million people has been increasing. These mega-events are responsible for the overall increase in displacement risk.
- In absolute terms, countries in Asia have the highest risk of being displaced. This is due to the fact that there are a large number of vulnerable people in Asia exposed to multiple natural hazards.
- When population size is accounted for small island states face disproportionately high levels of displacement risk, with Antigua and Barbuda, Haiti and Cuba being among the twenty most at-risk countries.
- Approximately 30 per cent of the pastoralists in northern Kenya, southern Ethiopia and south-central Somalia are at risk of becoming permanently displaced from their way of life between now and 2040, even if climate change does not make droughts more frequent or severe.

Displacement risk drivers:

- Displacement risk is measured in the following way: **Risk = Hazard x Exposure x Vulnerability**. The quadrupling of risk since the 1970s is due to the fact that exposure has increased much more quickly than vulnerability has been reduced whereas the occurrence of hazards has remained largely unchanged.
- Climate change may increase displacement risk in the future in at least two ways: first, by increasing the frequency and intensity of some weather-related hazards; and second by increasing certain communities' vulnerability and reducing thresholds at which point people become displaced.
- The primary driver of increased in exposure since the 1970s has been rapid, unplanned development in hazard-prone areas in developing countries. This rapid urbanisation concentrates large numbers of vulnerable people in dangerous locations.
- Weak or corrupt governance structures can further exacerbate this dangerous process by creating incentives for people to move into hazard-prone areas – or forcing them to live there.
- Conflict and generalised violence affects several of the most at-risk countries, further increasing the vulnerability of communities, undermining their ability to resist and cope with natural hazards.

The way forward:

- A disaster is not defined by the number of fatalities, the amount of economic losses or the number of people displaced. It is all of these things – and other impacts – together.
- The drivers of disaster-related displacement risk in particular are the same as the drivers of disaster risk in general. Thus most measures taken to reduce disaster risk – such as the adoption and enforcement of land use plans and stronger building codes, diversifying and strengthening the livelihoods of the rural and urban poor – will also reduce displacement risk.
- As the world's governments convene in 2015 and 2016 to agree on global disaster risk reduction, climate change adaptation and sustainable development goals, they have a unique opportunity to address displacement risk and several other objectives simultaneously.
- Coordinated and coherent international policy agreements and plans between these different forums are critical for addressing displacement risk. Otherwise, governments risk artificially splintering one problem into multiple conceptual, operational and policy silos.

1. INTRODUCTION: KEY CONCEPTS RELATED TO DISPLACEMENT RISK

1.1 WHAT IS RISK?

In 2014 alone, the word risk appeared in global headlines in relation to public health issues (epidemics, side effects of medication), environmental concerns (species extinction, loss of biodiversity), national security (terrorist attacks, nuclear proliferation, breakdown of ceasefire agreements) and potential political, economic and financial crises (exchange rates, sovereign debt default, European Union membership). These are but a few of dozens of different contexts in which the word risk was used. For example, ahead of the World Economic Forum (WEF) in Davos in January 2015, the WEF published the tenth edition of its annual Global Risks report. It examines 28 risks across five different categories (economic, environmental, geopolitical, societal and technological) (Figure 1.1).[1]

What is common to each is the possibility that something undesirable may occur at some point in the future. Inherent to the concept of risk are two important features:

1. the likelihood or probability that something will occur; and
2. the anticipatory focus of thought and attention on the future.

If one's home has just been destroyed in an earthquake, that risk has already been realised. The goal, therefore, is to take stock of these risks and to then mitigate them or, when that is not possible, to prepare for them.

The examples above demonstrate that risks are an inevitable part of life. Some of them cannot be avoided: foreign currency exchange rates fluctuate, but the use of currency itself is unavoidable. For policymakers, it is crucial to know which risks can be effectively reduced and which cannot. Risks they cannot or do not have the means to reduce must be managed through contingency plans or transferred via mechanisms such as insurance.

1.2 RISK IN THE CONTEXT OF DISASTERS

The concept of risk has been applied to disasters for centuries. In 1598, the Netherlands established the Chamber of Insurance and Average which by 1603 had ruled on approximately 89 cases.[2] Merchants such as the Dutch East India Company soon adopted an approach of risk reduction and risk management to address potential losses due to piracy or bad weather or shipwrecks. Merchants reduced risks associated with piracy by equipping ships with guns and sailing in convoy. They managed weather-related and navigational risks by splitting assets among different vessels; and they transferred risks by insuring their vessels and cargo against losses.[3] Even if Dutch merchants and insurers regarded a storm at sea as an 'act of God' they, nevertheless, recognised that it was in their power to do something about it.

The 1755 Lisbon Earthquake (and its associated tsunami) provoked an intellectual debate that informed both the European Enlightenment in general as well as Europeans' understanding of disasters in particular. The Lisbon Earthquake has been referred to as the first 'modern' disaster due to the fact that Voltaire's and Rousseau's analyses of it emphasised natural and social – rather than supernatural – causes.[4]

Two decades later, Diderot and Adam Smith similarly attributed at least some of the blame for the 1769 – 1770 Bengal famine, which killed an estimated ten million

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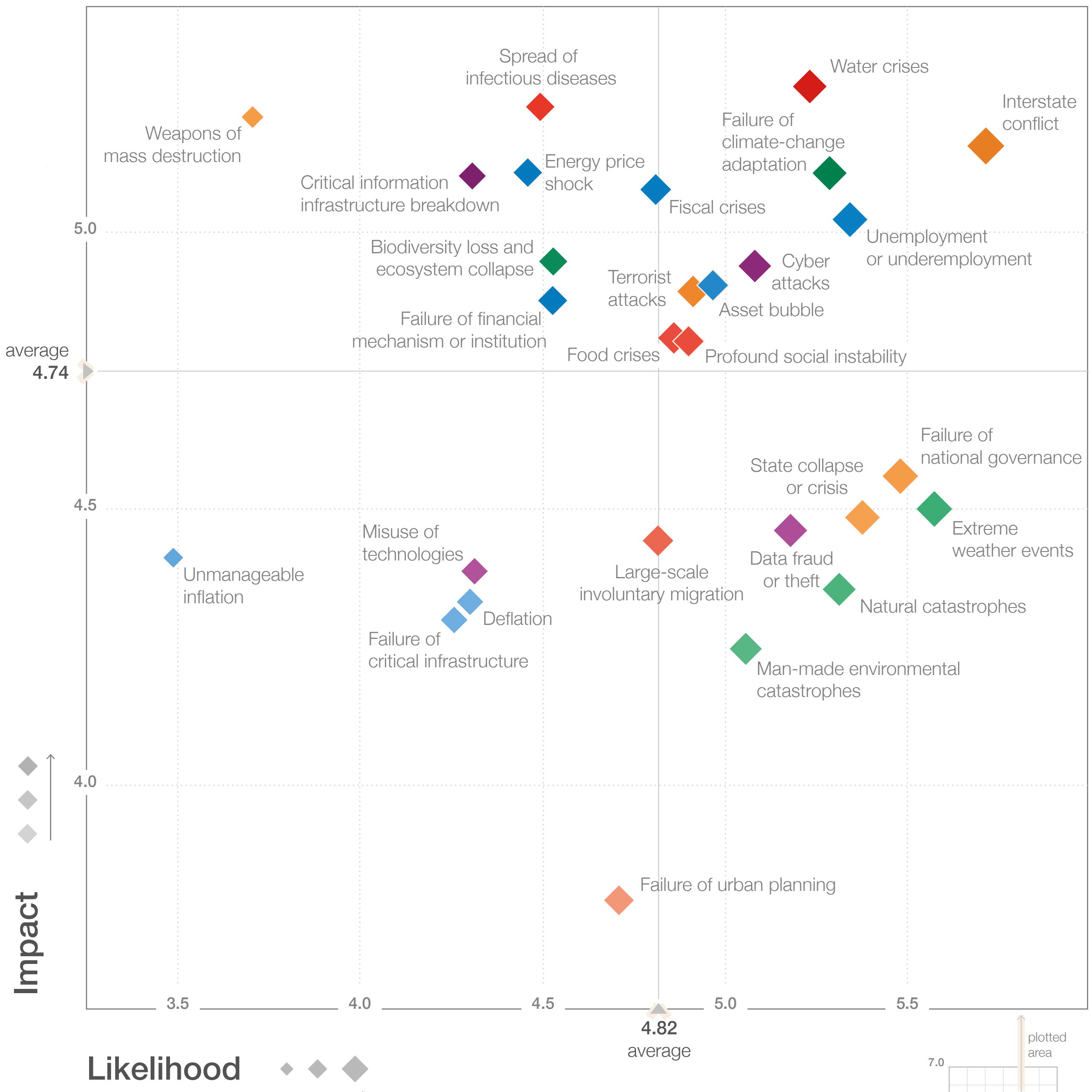
1 World Economic Forum, 2015, Global Risks 2015 (http://goo.gl/tplpP4), Geneva, Switzerland.

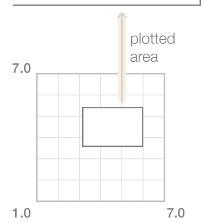
2 Go, S. 2009. *Marine Insurance in the Netherlands 1600-1870: A Comparative Institutional Approach.* Amsterdam University Press.

3 *Ibid.*

4 Dynes, R.R. 2000. "The Dialogue between Voltaire and Rousseau on the Lisbon Earthquake: The Emergence of a Social Science View." *International Journal of Mass Emergencies and Disasters* 18 (1), pp.97–115.

Figure 1.1: 2015 Global Risk Landscape (Source: World Economic Forum 2015)





Top 10 risks in terms of **Likelihood**	Top 10 risks in terms of **Impact**
1 Interstate conflict	1 Water crises
2 Extreme weather events	2 Spread of infectious diseases
3 Failure of national governance	3 Weapons of mass destruction
4 State collapse or crisis	4 Interstate conflict
5 Unemployment or underemployment	5 Failure of climate-change adaptation
6 Natural catastrophes	6 Energy price shock
7 Failure of climate-change adaptation	7 Critical information infrastructure breakdown
8 Water crises	8 Fiscal crises
9 Data fraud or theft	9 Unemployment or underemployment
10 Cyber attacks	10 Biodiversity loss and ecosystem collapse

Categories

- Economic
- Environmental
- Geopolitical
- Societal
- Technological

Indians,[5] to the mismanagement of the situation by the British colonial authorities.[6]

> *The drought in Bengal, a few years ago, might probably have occasioned a very great dearth. Some improper regulations, some injudicious restraints imposed by the servants of the East India Company upon the rice trade, contributed, perhaps, to turn that dearth into a famine.*[7]

By 1868, the idea that human decisions influenced the outcome of the Bengal famine disaster was widely accepted, including by W.W. Hunter, the colonial Indian civil servant and historian of India:

> *The question as to who was responsible for their death, is the first idea that suggests itself to an Englishman of the present day. . . . The loss of life was accepted as a natural and logical consequence of the loss of the crop. [A]n Englishman reading that tragical story at the present day cannot rest content with this [explanation].*[8]

In Hunter's view the famine was the result of a failure to believe and respond to warnings of impending crop failures and to adequately respond once the crops did fail.

It took centuries for governments to adopt the European Enlightenment's view of disasters. Under the League of Nations, the International Union for the Relief of Disasters, focused on disaster response and espoused a pre-Enlightenment view of disasters, "class[ing]" events such as "earthquakes, eruptions, floods, cyclones, tidal waves, famines & conflagrations . . . as 'Acts of God.'"[9]

The reorientation from disaster response to disaster prevention and preparedness did not come about until the 1990s, when the UN launched the International Decade of Natural Disaster Reduction (IDNDR). In 2005 the *Hyogo Framework for Action* (HFA) declared an ambition by 2015 to achieve "the substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of communities and countries."[10]

The HFA focuses on disaster risk reduction (DRR) since it would be impossible to prevent all future disasters from occurring. By 2015, the aim of reducing future disaster impacts through DRR has been enshrined in national laws and policies, and incorporated in other policy areas such as the *United Nations Framework Convention on Climate Change* and the Sustainable Development Goals. DRR is often indistinguishable from climate change adaptation (CCA): both aim to minimise the impacts of weather-related hazards on future generations.

1.3 COMPONENTS OF DISASTER RISK

> *"Not every windstorm, earth-tremor, or rush of water is a catastrophe. ... So long as the ship rides out the storm, so long as the city resists the earth-shocks, so long as the levees hold, there is no disaster."*[11]
>
> L.J. Carr

Political support for the IDNDR, as well as the HFA, was supported by evidence that revealed how economic development policies, urbanisation patterns, poverty, weak governance and environmental degradation influence disaster outcomes. The IDNDR and the HFA consolidated this wide body of research into a conceptual model of disaster risk (Figure 1.2).

Figure 1.2: General equation of disaster risk

RISK = HAZARD x EXPOSURE x VULNERABILITY

According to this formulation, a disaster occurs when – and only when – vulnerable people or assets are exposed to a particular hazard. During the week of 24-31 January 2015, for example, there were 39 earthquakes in and around Japan, most between 4.0 and 5.1 magnitude.[12] They did not result in any significant disasters because the people and buildings exposed to the earthquakes were not vulnerable or because the earthquakes occurred in sparsely inhabited areas (four of the earthquakes occurring off the Kuril Islands).

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5 Hunter, W.W. 1868. *The Annals of Rural Bengal.* Smith, Elder, and Co. p.34.

6 Muthu, S. 2009. *Enlightenment against Empire.* Princeton University Press.

7 Smith, A. 1776. *An Inquiry into the Nature and Causes of the Wealth of Nations* (5th Ed.), Vol. 4, Chap. 5, Para. 45. Metheun, http://goo.gl/X9Kk7g.

8 Hunter, 1868, pp.34-35.

9 TIME. 1928. The League of Nations: Most Favored Nations, http://goo.gl/NCk3el, *Time* Vol 11, No. 19, 7 May 1928.

10 United Nations International Strategy for Disaster Reduction (UNISDR), 2005. *Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters,* http://goo.gl/m2tgQw.

11 Carr, L.J. 1932. "Disaster and the Sequence-Pattern Concept of Social Change." *American Journal of Sociology* 38 (2), pp.207–18.

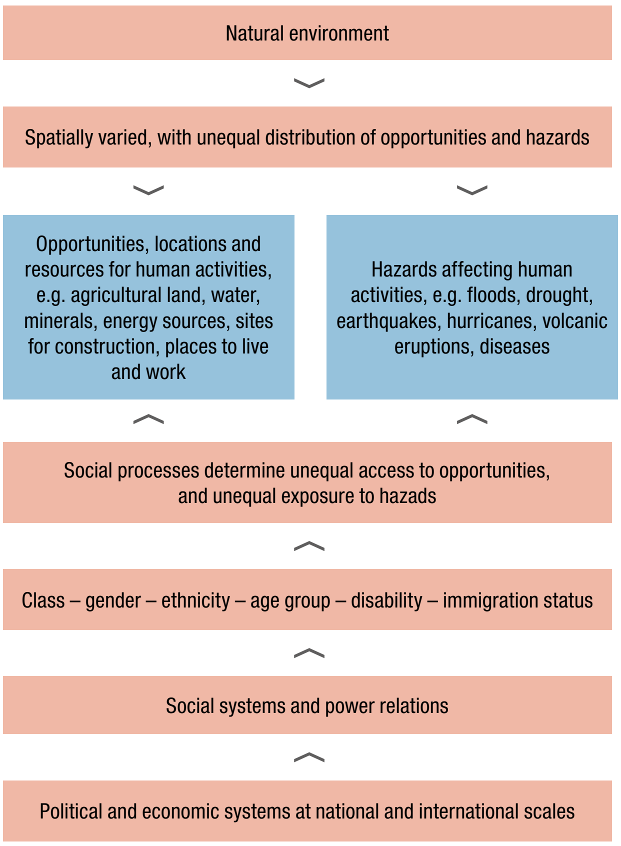
12 Japan Meteorological Agency. 2015. Information on seismic intensity at each site: earthquakes in the last week, http://goo.gl/BSw1k. Tokyo: Japan Meteorological Agency.

In terms of how disasters are understood, one paradigm shift occurred when European Enlightenment thinkers reframed disasters as a mixture of natural hazards and human factors. Another occurred during the twentieth century when researchers detected a human influence on all three elements of disaster risk, including the behaviour of 'natural' hazards.

This human-centred conceptualisation of disaster risk enables one to map the relationships among the different causal factors (Figure 1.3). Each disaster is the manifestation of the way these risk factors have come into contact in a given place and time. Once these drivers have been identified, they can be addressed in ways that reduce risk or manage it.

For example, the discovery of tectonic theory led to the development and implementation of seismic building codes that have saved an untold number of lives and prevented people from being displaced by earthquakes in countries that have adopted them. In Bangladesh, advances in meteorological prediction, combined with preparedness planning, have resulted in cyclone early warning systems and mass evacuations, reducing the number of fatalities associated with these storms.

Figure 1.3: Factors and relationships that influence disaster risk (Source: Wisner et al., 2003)



BOX 1: UNPACKING THE COMPONENTS OF DISASTER RISK

It is widely considered that disaster risk is generally increasing due to increases in ***exposure***. For example, populations continue to grow in coastal areas, regardless of the fact that they are subject to hurricanes, storm flooding, tsunami risk and sea-level rise. The problem is not only that development forces more people to settle in exposed areas or that exposed areas many times offer considerable development advantages associated with location, natural resource availability and access to transport routes and markets, but also that those that are living in these exposed areas often do so in a highly vulnerable fashion, using inadequate masonry techniques in earthquake-prone areas and settling unstable hillsides surrounding coastal cities with high precipitation levels. This leads to landslides affecting extra-legal settlements and downstream flooding caused by development-driven reductions in permeable land upstream.

Climate change and other anthropogenic causes increase ***hazard*** levels. These increases are not just through increases in magnitude and frequency of extreme (or intensive) events, but also due to the changing averages that may significantly increase the number of non-extreme (or extensive) events that together lead to substantial losses.

Vulnerability is the most difficult of the three components of disaster risk to measure. Vulnerability is a composite indicator that is influenced by several social, economic, political and other factors. In terms of modelling risk, the identifying and weighting of vulnerability indicators, such as GDP per capita or governance capacities, is based upon statistical regression analyses of historical events. Vulnerability levels are generally considered to be slowly declining on a global level, although not at a sufficient pace to keep increases in exposure in check. On a local scale, vulnerability levels vary widely with some communities locked into cycles of extreme and/or chronic vulnerability, such as those facing flooding from sea-level rise.

Considering all three of these variables together – sustained high vulnerability levels with increasing exposure and hazard levels – helps put these increases in disaster risk into clearer context.

BOX 2: THE HUMAN INFLUENCE ON 'NATURAL' HAZARDS

In the 1960s and 1970s, researchers made significant advances in the understanding of natural hazards. Although humans have studied earthquakes since antiquity, modern seismology did not take root until the 1960s when scientists accepted the theory of plate tectonics. The more research on hazards progressed, the more scientists understood how human activity shaped them.

For example, when low-lying coastal and riverside settlements expand to accommodate population growth, people begin moving from historically safe areas into more hazard-prone ones. Cities climb hillsides and extend onto flood plains or land reclaimed from the sea or wetlands. This expansion occurs all over the world, from California to Mumbai, from Rio to Taipei. It increases disaster risk in two ways: increasing the number of people exposed to natural hazards and changing the character of the hazards themselves. Examples include:

- In Dhaka, Bangladesh, entire neighbourhoods have been built upon on drained bodies of water or wetlands. The soil upon which these buildings stand is prone to liquefaction – it liquefies in the event of an earthquake – thereby magnifying the danger for those now living on this land.[13]

- Urban growth on forested hillsides also changes the character of hazards: the removal of trees during home construction destabilises hills and reduces the capacity of the ground to absorb water. This increases the likelihood of a rain-triggered landslide – and of a home being in its way.

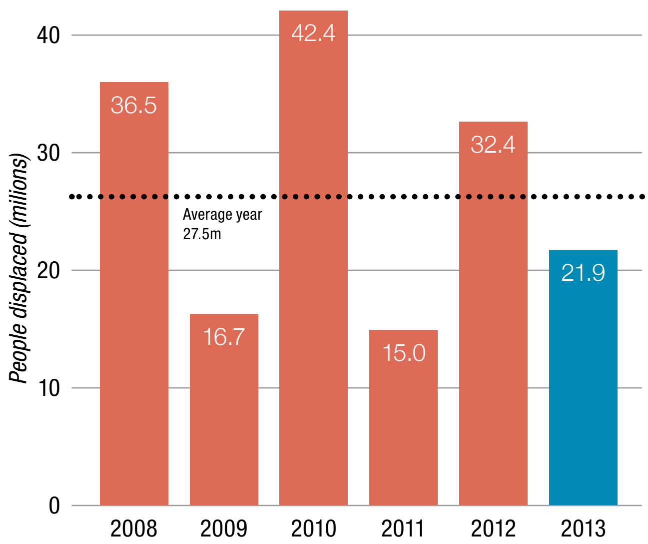
- Settlement growth along rivers can influence the behaviour of floods. Developers will dredge wetlands and straighten the course of windy rivers (a process known as channelisation). Channelised rivers flow more quickly and the result of paving over former wetlands is faster runoff into the river when it rains. Ultimately, this increases flood risk for those living along the river and especially those living downstream.

1.4 DISPLACEMENT IN THE CONTEXT OF DISASTERS AND DISASTER RISK

> *Social change in disaster is catastrophe, plus cultural collapse, plus reorganization – it is no one of these alone, but all of them together."*
>
> L.J. Carr[14]

According to IDMC's most recent *Global Estimates,* nearly 22 million people were newly displaced in 2013 (the last year for which IDMC has comprehensive data) and some 160 million people have been displaced since 2008 (Figure 1.4).[15] Since 1970, and taking into account increases in population, the number of people at risk of being displaced has more than doubled, and the risk is increasing even more quickly for weather-related hazards (Figure 1.5). Section 3 indicates what is driving these trends. Due to lack of data on the rate at which people return, relocate elsewhere or integrate into new communities, it is not yet known how long most people remain in displacement following a disaster.

Figure 1.4: Disaster-related displacement by year (2008 – 2013) (Source: IDMC, 2014)



The impact of disasters on displacement has been documented throughout history. Hunter's *Annals of Rural Bengal* compares the impact of the drought and famine in 1770 to the downfall of the Bengali city of Gour two centuries earlier, making note of the displacement it caused:

> *As the famine of 1770 stands an appalling spectre on the threshold of British rule in India, so the year in which Bengal was incorporated into the Mogul Empire is marked by a disaster from which the Hindu metrop-*

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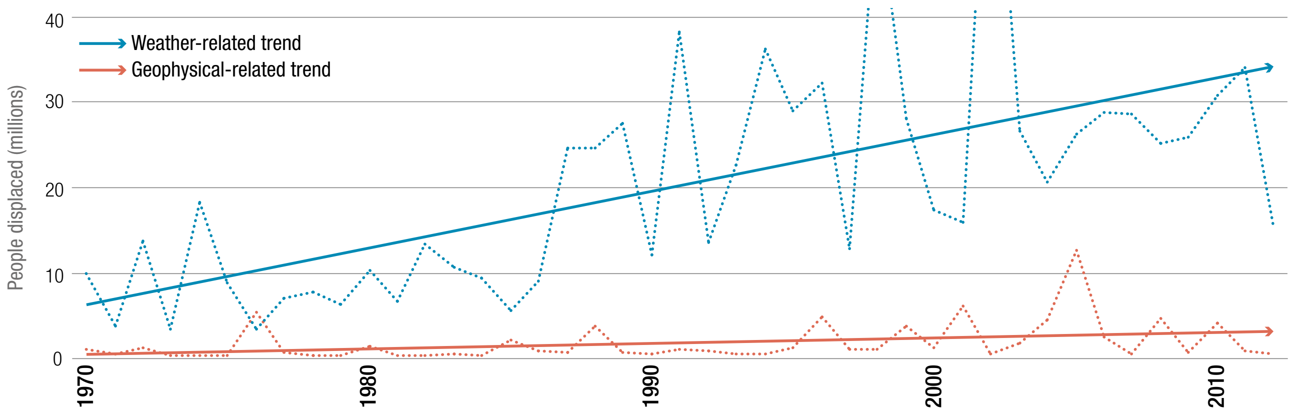
[13] UNISDR. 2011. Revealing risk, http://goo.gl/ywjV6D. In *2011 Global Assessment Report on Disaster Risk Reduction.*

[14] Carr, *op. cit.,* p.215.

[15] IDMC, 2014, *Global Estimates 2014: People displaced by disasters,* http://goo.gl/fMvkM7.

Figure 1.5: Displacement trends: geophysical and weather-related hazards (Source: IDMC, 2014)



olis never recovered. 'Thousands died daily,' writes the historian of Bengal. 'The living, wearied with burying the dead, threw their bodies into the river. This created a stench which only increased the disease. The governor was carried off by the plague. The city was at once depopulated, and from that day to this it has been abandoned. At the time of its destruction it had existed two thousand years. It was the most magnificent city in India, of immense extent, and filled with noble buildings. It was the capital of a hundred kings, the seat of wealth and luxury. In one year was it humbled to the dust, and now it is the abode only of tigers and monkeys.'[16]

Disasters have been most easily and typically characterised in terms of direct damage and loss to lives and capital stocks as well as numbers of affected persons and the homeless. Concern for indirect or secondary impacts has existed for some time but given less overall attention than direct losses. Attention to such secondary effects has increased notably over the years mainly as related to income flows and employment, impacts on national product and inflation, among others. Little concern was shown for measuring or understanding forced population migration and movement. This interest prompted IDMC to begin monitoring and publishing annual estimates of disaster-induced displacement, and to monitor and report on protection risks facing those been displaced in the aftermath of such events.[17]

DRR and CCA aim to mitigate the impacts of future hazards by taking appropriate action in the present. Taking informed decisions about future risks requires some information about the future and the ongoing changes to underlying risk drivers. Thus, IDMC has begun producing evidence-based estimates of the risk of disaster related displacement to inform decision-makers of the scale of the challenge and to help them reduce and manage the risk.

This analysis may also be useful for disaster management authorities and humanitarian actors. Situating displacement within a disaster risk framework may mean altering the way people conceptualise and respond to disasters (Figure 1.6). This way of thinking, epitomised by the concept of 'building back better', acknowledges that disaster response interventions will influence future disaster risks. The goal of interventions is to respond to people's immediate needs while simultaneously reducing their vulnerability to future hazards.

Displacement itself is not just an outcome of disaster: it is also a driver of future disaster risk and places people at a higher risk of impoverishment and human rights abuses while exacerbating any pre-existing vulnerability.[18] Forced from their homes or places of residence, men and especially women and children often face heightened protection risks such as family separation and sexual and gender-based violence.[19]

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[16] Hunter, 1868. p.29.

[17] IDMC, 2013, *Disaster-induced displacement in the Philippines: The case of Tropical Storm Washi/Sendong,* http://goo.gl/U8MRBK. IDMC, 2010, *Briefing paper on flood-displaced women in Sindh Province,* http://goo.gl/ijFC5m, Pakistan.

[18] UNISDR, 2013. Chair's Summary Fourth Session of the Global Platform for Disaster Risk Reduction Geneva, http://goo.gl/Yru7KH, 21–23 May 2013.

[19] See the *Guiding Principles on Internal Displacement,* http://www.idpguidingprinciples.org, 1998 and the *IASC Operational Guidelines on the protection of persons in situations of natural disasters,* http://goo.gl/Ttc0Lq, 2011. Also, Cernea's Impoverishment Risks and Reconstruction approach analyses forced resettlement resulting from large-scale development projects and outlines eight basic risks faced by displaced people, which are also common to disaster-induced displacement: landlessness; joblessness; homelessness, marginalisation, food insecurity, increased morbidity, loss of access to common property resources and social disarticulation. Cernea, M. 1999, "Why Economic Analysis is Essential to Re- settlement: A Sociologist's View", in Cernea, M. (ed.), *The Economics of Involuntary Resettlement: Questions and Challenges,* The World Bank.

BOX 3: KEY TERMS

Climate change is a change in the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external pressures, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.[20]

Disaster is "a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources."[21] Disasters result from a combination of risk factors: the exposure of people and critical assets to single or multiple hazards, together with existing conditions of vulnerability, including insufficient capacity or measures to reduce or cope with potential negative consequences.

Disaster risk is normally expressed as the probability of an outcome (e.g., the loss of life, injury or destroyed or damaged capital stock) resulting from the occurrence of a damaging physical event during a given period of time. In this study, the disaster outcome in question is displacement. Disaster risk is considered to be a function of **hazard**, **exposure** and **vulnerability**.

The United Nations' *Guiding Principles on Internal Displacement* observes that **displacement** may occur as a result of, or in order to avoid the effects of, disasters.[22] Displacement includes all forced movements regardless of length of time displaced, distance moved from place of origin and subsequent patterns of movement, including back to place of origin or re-settlement elsewhere. This definition also encompasses anticipatory evacuations.

Exposure refers to the location and number of people, critical infrastructure, homes and other assets in hazard-prone areas.

'Natural' **hazards** are events or conditions originating in the natural environment that may affect people and critical assets located in exposed areas. The character of these hazards is often strongly influenced by human actions, including urban development, deforestation, dam-building, release of flood waters and high carbon emissions that contribute to long-term changes in the global climate. Thus, their causes are often less than 'natural'.

Vulnerability is the propensity or predisposition to be adversely affected by a hazard.[23]

1.5 MEASURING DISASTER AND DISPLACEMENT RISK

> *"Access to information is critical to successful disaster risk management. You cannot manage what you cannot measure."* [24]
>
> Margareta Wahlström, Special Representative of the Secretary-General for Disaster Risk Reduction

In this era of innovation, 'big data' and it is easy to find evidence and examples of human and economic development, such as GDP growth, longer life expectancies and rapid diffusion of new technologies, even to the poor. However, the potentially negative consequences of these development processes, such as increased disaster risk, are seldom acknowledged or measured. In order to measure disaster risk (be it displacement, economic loss or mortality), one needs relatively complete information about past events and a credible means of projecting this information into the future.

> *[T]wo different conceptions of logic become necessary – one for the facts or things that have happened, and one for the events that are likely to happen in the future. Thus, the historiographic logic of facts has to be supplemented with a logic of probability.*[25]

Measuring disaster risk (especially the risk of economic losses) is the core business of insurance and reinsurance companies. What risks are measured and to whom this information is available, is limited. To generate profit and recoup the cost of expensive risk models, insurers target potential customers who can afford the insurance premiums. Knowing that poorer people and communities are unlikely to be able to afford the premiums, insurance companies have less incentive to measure the

20 Adapted from Intergovernmental Panel on Climate Change (IPCC), 2012. *Managing the Risks of Extreme Events and disasters to Advance Climate Change Adaptation, Special Report of the Intergovernmental Panel on Climate Change,* http://goo.gl/DDXAg, Cambridge University Press, p.557.

21 UNISDR, 2009, *UNISDR Terminology on Disaster Risk Reduction,* http://goo.gl/JD7HHz.

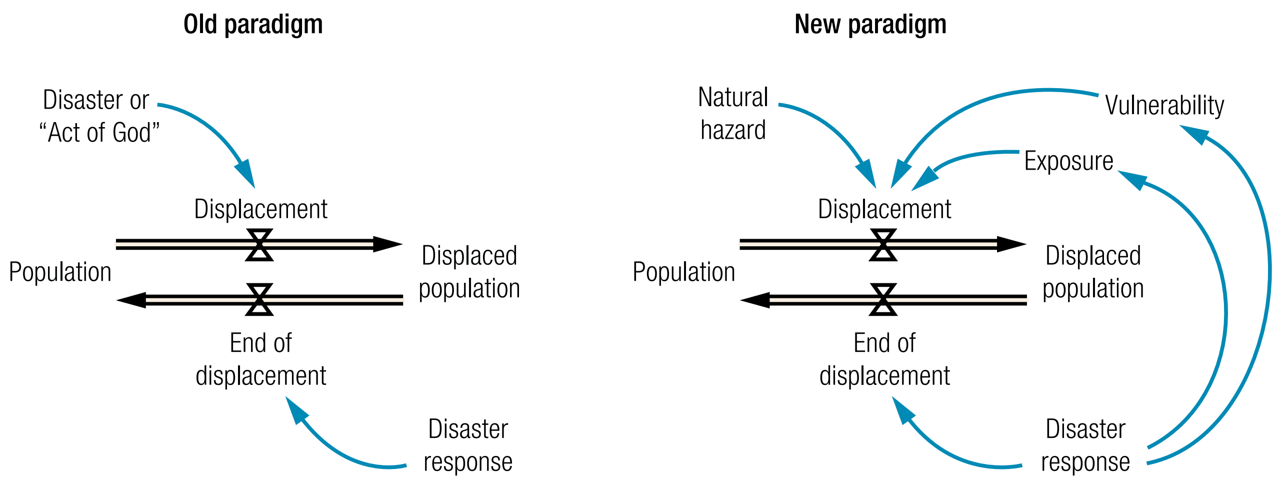
22 United Nations, 1998, *Guiding Principles on Internal Displacement,* http://goo.gl/vBd9dr.

23 Intergovernmental Panel on Climate Change (IPCC), 2012, Glossary of terms. In *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation,* http://goo.gl/WszLzM, A Special Report of Working Groups I and II of the IPCC, pp.555-564.

24 UNISDR, 2012, *Governments must recognize their stock of risk - MDG Report,* http://www.unisdr.org/archive/28569.

25 Dombrowsky, W.R. 1995. "Again and Again: Is a Disaster What We Call 'Disaster'?: Some Conceptual Notes on Conceptualizing the Object of Disaster Sociology", http://www.ijmed.org/articles/325/. *International Journal of Mass Emergencies and Disasters* 13 (3), pp.241–54.

Figure 1.6: Old and new ways of understanding responses in relation to disaster risk



risks these people confront. Thus, the disaster risks that they measure represent a small fraction of all disaster risks around the world.

Furthermore, as for-profit entities operating in a competitive environment, insurance and reinsurance companies are justifiably protective of their data. This means that access to the information about risks is restricted to those who can pay for it.

In the public sector, however, the HFA has made the measurement of disaster risk a public responsibility, and one that includes more than just economic losses. UNISDR has consolidated much information and research on disaster risks in its biennial *Global Assessment Reports* (GARs), making economic risk information more transparent and raising awareness of disaster mortality risk. IDMC has adapted the methodology, probabilistic risk modelling, commonly used to compute these other disaster risks.

IDMC's longer-term objective is to generate probabilistic risk information that quantifies expected displacement based on both annual averages as well as the effect of disaster events of different return periods (for example, the expected number of displaced based on a 100-year return period flooding event). At this point, such a model is not possible due to various data limitations, including:

- incomplete data – different databases apply different thresholds for including loss events
- inconsistent data – there are differences in methodologies among national databases
- short sample period – data from 1970 to the present does not allow for modeling events with long return periods (e.g., once every 500 years)
- inherent sources of uncertainty, bias and error due largely to these data limitations.

Despite these limitations, IDMC has estimated displacement risk using the best available national and global data related to sudden-onset hazards such as earthquakes, floods, storms and landslides. Slow-onset hazards pose their own unique set of problems. For example, due to the complex interaction of the numerous factors that lead to displacement during and following droughts, a different methodology, system dynamics modelling, was used to compute this particular disaster risk. A full description of IDMC's methodologies is included in the Annex.

Table 1.1: Common disaster risk metrics

Economic or financial disaster risk metric	Description
Average annual loss (AAL); average annual displacement	The average number of losses – or the average amount of displacement – expected per year. AAL provides the most intuitive understanding of the risk of loss, often setting the baseline from which discussion may ensue.
Probable maximum loss (PML); probable maximum displacement	PML (also called 'loss exceedance') illustrates the range under which losses may be greater or less than the AAL. PML is usually expressed as a curve with loss levels (e.g., $ billions) on one axis and the return period for that given size of losses on the other (e.g., a one to 500-year range). The concept of PML can be further simplified to express the relationship between the number of events recorded and the specific amount of loss or displacement.

2. MEASURING RISK: WHO IS AT RISK? WHERE ARE THEY LOCATED?

2.1 MEASURING HISTORIC DISPLACEMENT AND FUTURE DISPLACEMENT RISK

This section reviews the findings of IDMC's displacement risk modelling in terms of historic modelled displacement estimates and projected future displacement risk. It examines how configurations of hazard, exposure and vulnerability have resulted in displacement during the past several decades as a basis for looking ahead into the future. Historic displacement and future displacement risk are linked: data and evidence of past displacement is needed to estimate the risk of future displacement. Accurate, forward-looking projections of displacement risk are in turn required to reduce the likelihood that people will be forced from their homes in the future.

For sudden-onset hazards such as earthquakes, storms, floods, tsunamis and landslides, IDMC employs a technique called probabilistic risk assessment. In relation to slow-onset hazards such as droughts, IDMC assesses displacement risk using system dynamics modelling in order to account for these more complex phenomena. Both techniques are described below and in the methodological Annex.

2.2 HISTORIC DISPLACEMENT

2.2.1 Average historic displacement estimates

IDMC has been monitoring new events of disaster-related displacement on an annual basis since 2008. It is difficult to assess long-term trends or future displacement risk using only the data from this short time period. Therefore, IDMC estimated past displacement from 1970 onwards using the best available disaster-loss data and calibrating it using the five years of high-confidence estimates recorded in IDMC's Disaster-induced

Figure 2.1: Modelled annual displacement & historic displacement trends (1970–2013)

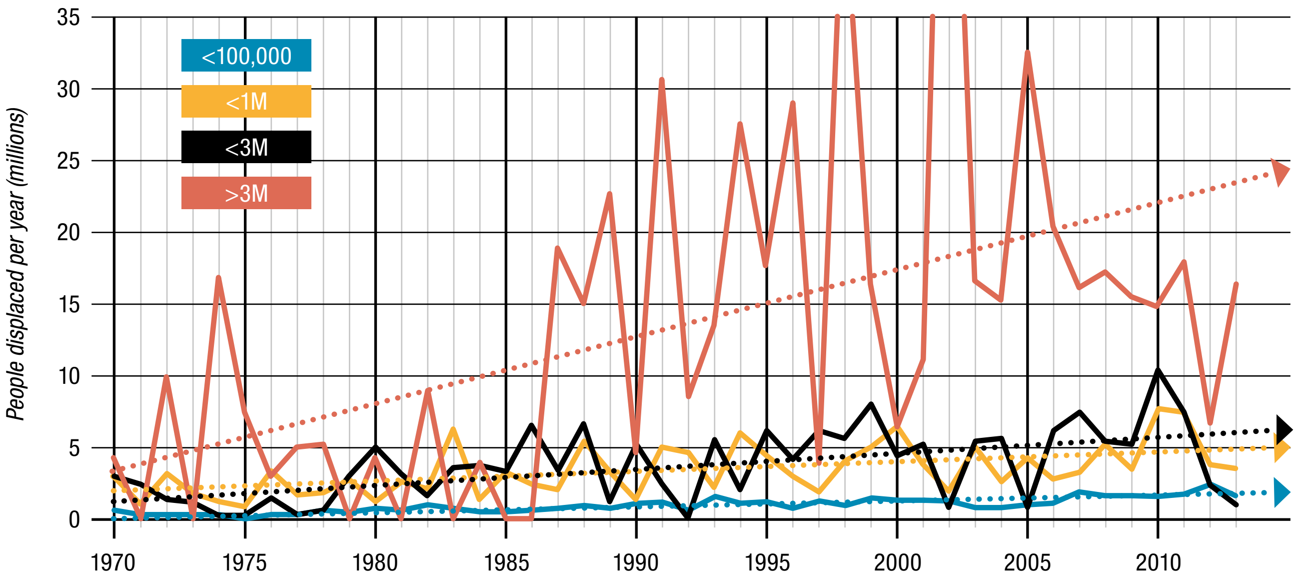
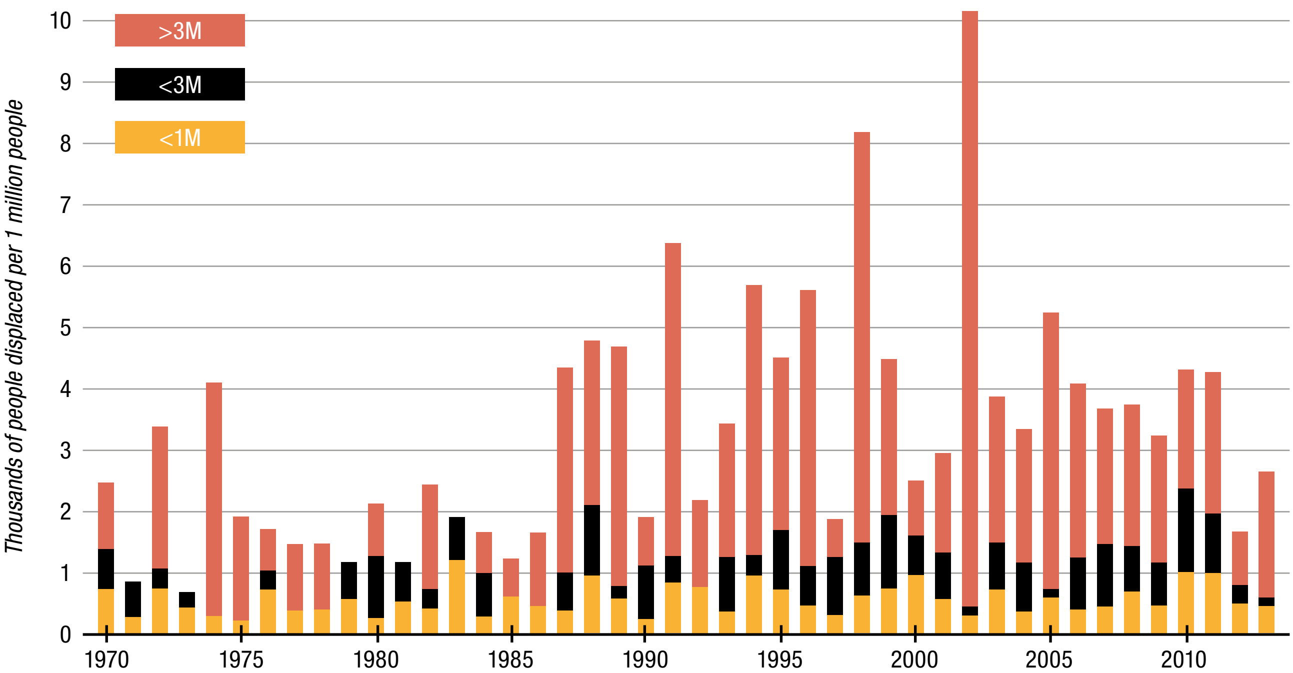


Figure 2.2: Global annual relative displacement per million people (1970-2013)



Displacement Database (DiDD).[26] The result is a model of 44 annual global estimates of disaster-induced displacement associated with recorded historical events (Figure 2.1).

IDMC's historical displacement model indicates that several things:

- in absolute terms, annual global displacement figures (also called 'realised risk') have quadrupled over the past four decades
- this increase is mostly driven by the more frequent occurrence of mega-events since the mid-1980s
- the magnitude of displacement varies widely from year to year due to the occurrence of large, very large or mega-events.

This increase in displacement risk reveals that exposure has increased more quickly than vulnerability has been reduced. While population growth accounts for some of this increase in displacement, the risk of displacement is increasing twice as fast as the world's population is growing. Thus, IDMC's analysis indicates that displacement risk is observed to have increased since the 1970s even when population size is taken into consideration (Figure 2.2).

In addition to more people living in hazard-prone areas, there are two additional factors that are responsible for some of the observed increase in displacement risk:

- improvements in reporting disaster losses since the 1980s and
- improvements in live-saving evacuations and disaster response.

Beginning in the mid-1980s, there has been a dramatic improvement in the way that disaster impacts are recorded. The establishment of global and national disaster-loss databases has meant that a larger share of disaster impacts are recorded and made available for analysis. Since the 1970s, there have also been significant improvements in early warning systems, pre-emptive evacuations and life-saving disaster responses. These have collectively reduced disaster mortality and led to increases in the number of people displaced during such events.

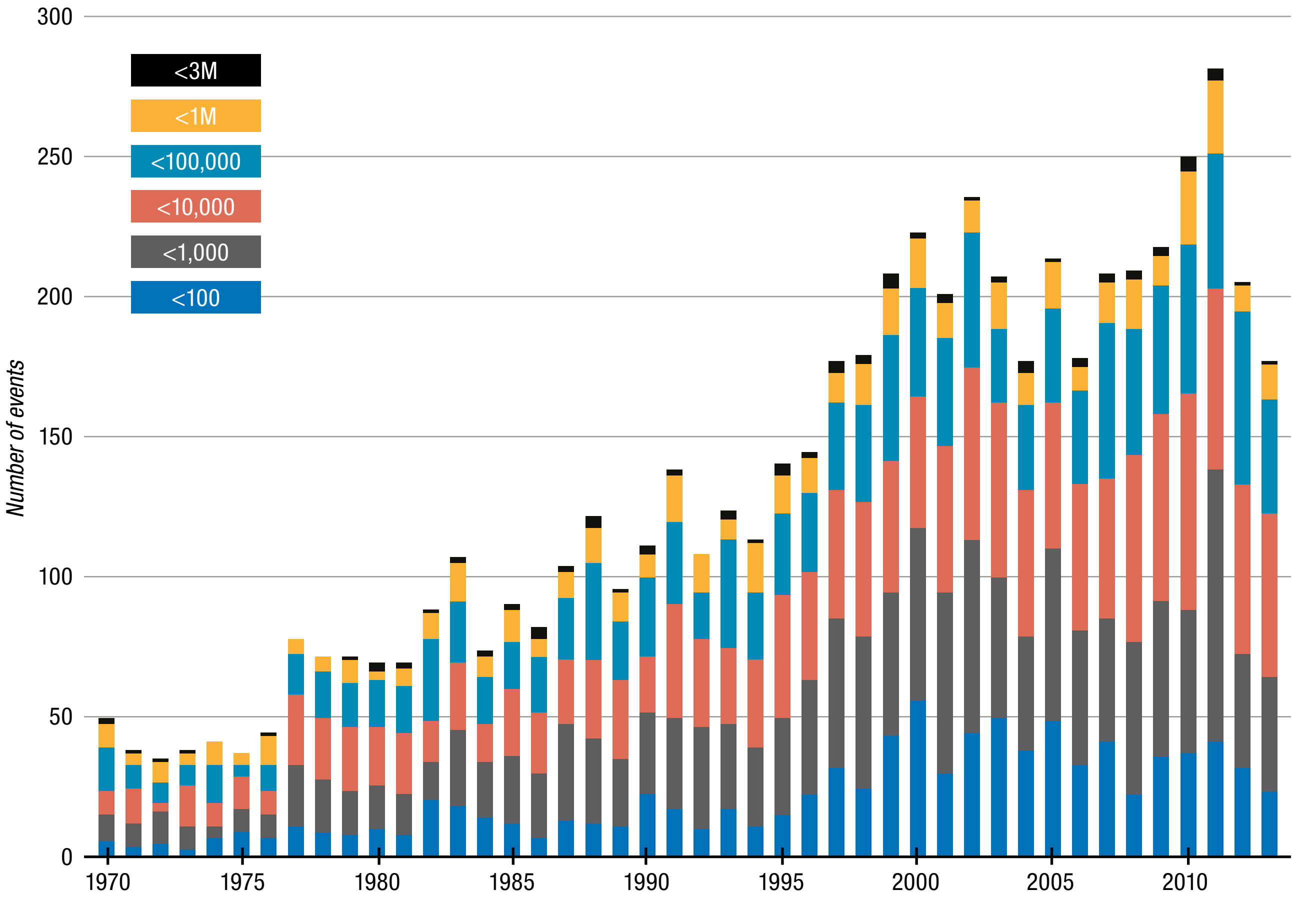
Table 2.1: Groupings of displacement events by size

Category	Magnitude
Mega-event	More than 3 million people displaced
Very large	1 – 3 million people displaced
Large	100,000 – 1 million people displaced
Medium-large	10,000 – 99,999 people displaced
Medium	1,000 – 9,999 people displaced
Small	100 – 999 people displaced
Very small	Fewer than 100 people displaced

Given the improvements in disaster reporting, it is no surprise that IDMC's historical displacement model reveals that the number of disasters that lead to displacement has increased (Figure 2.3). Between 1970 and 1980, there were an average of approximately 50 disaster-related displacement events per year. Since 1997, three to five times as many events have been recorded per year. The model also indicates that the number of large, very

26 The calibration methodology, based upon statistical regression analysis, is described in the Annex.

Figure 2.3: Modelled annual displacement events by magnitude of displacement



large and mega-events is also increasing. Given that improvements in disaster reporting relate to the inclusion of smaller events, the increase in the number of bigger events is driven by other factors, chiefly population growth in hazard-prone areas.

2.2.2 Distribution of events by size and frequency of occurrance

The modelled estimates of historic displacement may be examined in different ways to reveal other aspects of displacement risk. For example, one useful way to analyse this data is to assess how frequently events of a particular size and magnitude have occurred during the 44-year data set (Figure 2.4). This analysis reveals that most of the recorded events displaced between 1,000 and 100,000 people. While these events are not large enough to influence the global figures, disasters that displace tens of thousands of people can have devastating impacts at the sub-national and local level.

The fact that Figure 2.4 includes fewer small displacement events (fewer than 1,000 people displaced) than medium sized ones (10,000 – 100,000 people displaced) underscores the difficulty of obtaining data at the global level for small disasters. These disasters are associated with frequently occurring, low-intensity hazards. By virtue of their small size, they do not elicit an international humanitarian response and their impacts are thus omitted from global disaster loss databases. To compensate for these omissions and present a more comprehensive picture of displacement risk, IDMC would need to include data from national disaster loss databases in which the impacts of these small but frequently occurring events are recorded more systematically.

Figure 2.5 reveals the number of people displaced per event and Figure 2.6 reveals the number of people displaced per event once population size has been accounted for. Both of these figures confirm that the mega-events have a disproportionate impact on the global absolute and relative displacement risk estimates.

2.2.3 Demographic distribution of historic displacement risk

Displacement risk is closely related to human and economic development. After grouping countries into quintiles using the Human Development Index (HDI), IDMC examines how displacement risk was divided among these five groups. Figures 2.7 and 2.8 reveal that absolute and relative displacement risk is concentrated in countries in the third and fourth HDI quintiles. These are countries in which exposure has increased more quickly than vulnerability has decreased, largely due to rapid population growth in hazard-prone areas such as coastal cities. Further analysis is needed to understand how a country's movement from one quintile to another affects its displacement risk as well as the impact of displacement events on its development.

Figure 2.4: Modelled annual displacement size distribution (1970-2013)

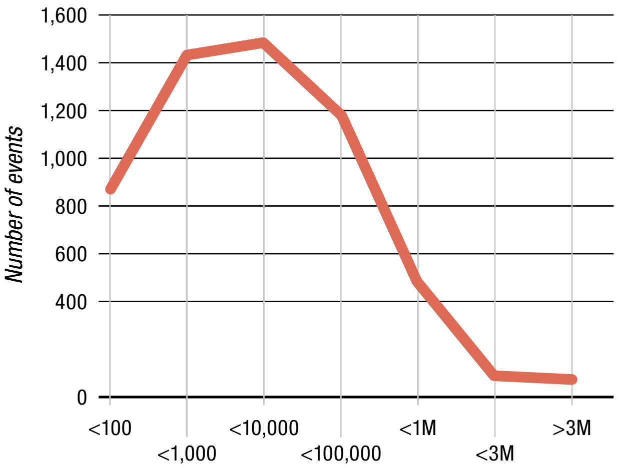


Figure 2.5: Modelled total global annual displacement per displacement size (1970-2013)

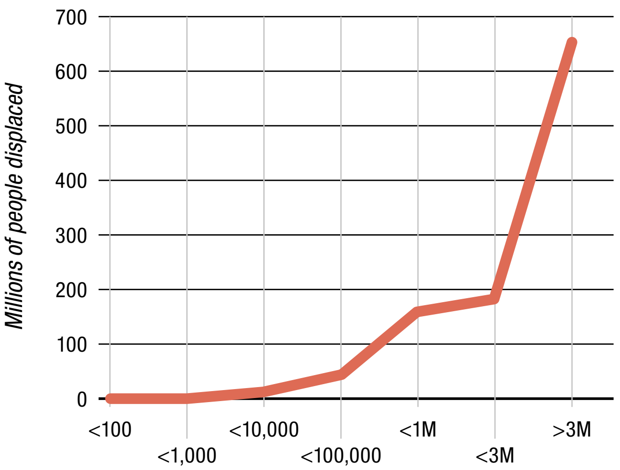


Figure 2.6: Modelled global annual relative displacement per displacement size (1970-2013)

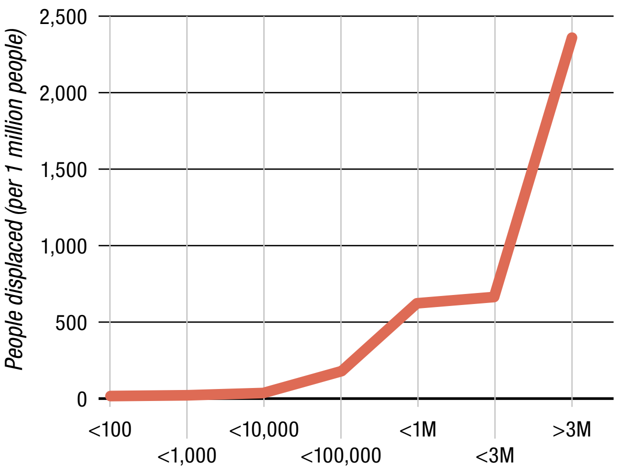


Figure 2.7: Annual Average Displacement Risk per Human Development Index quintile (2010)

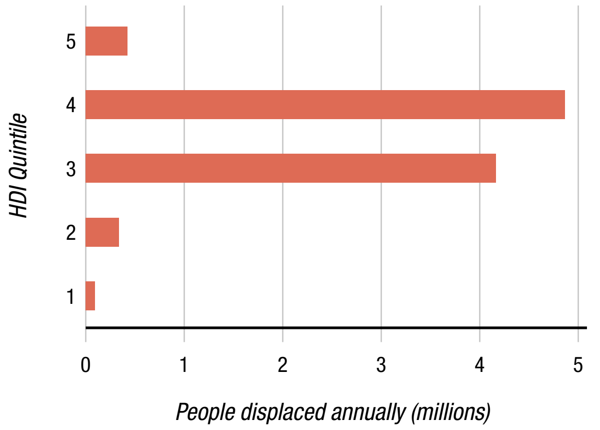
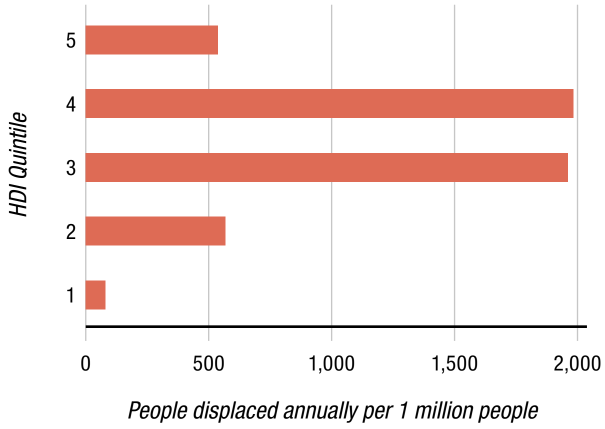


Figure 2.8: Annual Relative Displacement risk per Human Development Index quintile (2010)



2.2.4 Geographic distribution of historic displacement risk

Since 1970, Asia has accounted for most disaster-related displacement. This is due to the fact that there are many more vulnerable people in Asia exposed to multiple hazards than in other regions of the world. As one indicator of this large vulnerable population, the UN estimates that there are 571 million slum dwellers in the Asia-Pacific region, around 33 per cent of the region's urban dwellers and half of the world's population of slum dwellers.[27] In Bangladesh, Cambodia, Lao People's Democratic Republic, Mongolia and Nepal, it is estimated that a majority of the urban populations live in slums. These slums are often located in dangerous locations such as unstable hillsides, floodplains, riverbanks and on land reclaimed from the sea. Thus, it is no surprise that more people in Asia have been displaced by floods,

[27] United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and United Nations International Strategy for Disaster Reduction (UNISDR), 2012. Reducing Vulnerability and Exposure to Disasters: The Asia-Pacific Disaster Report 2012, http://goo.gl/KYpGs, Bangkok: ESCAP and UNISDR.

Figure 2.9: Total displacement by geographical region and hazard type (1970 – 2013) (log scale)

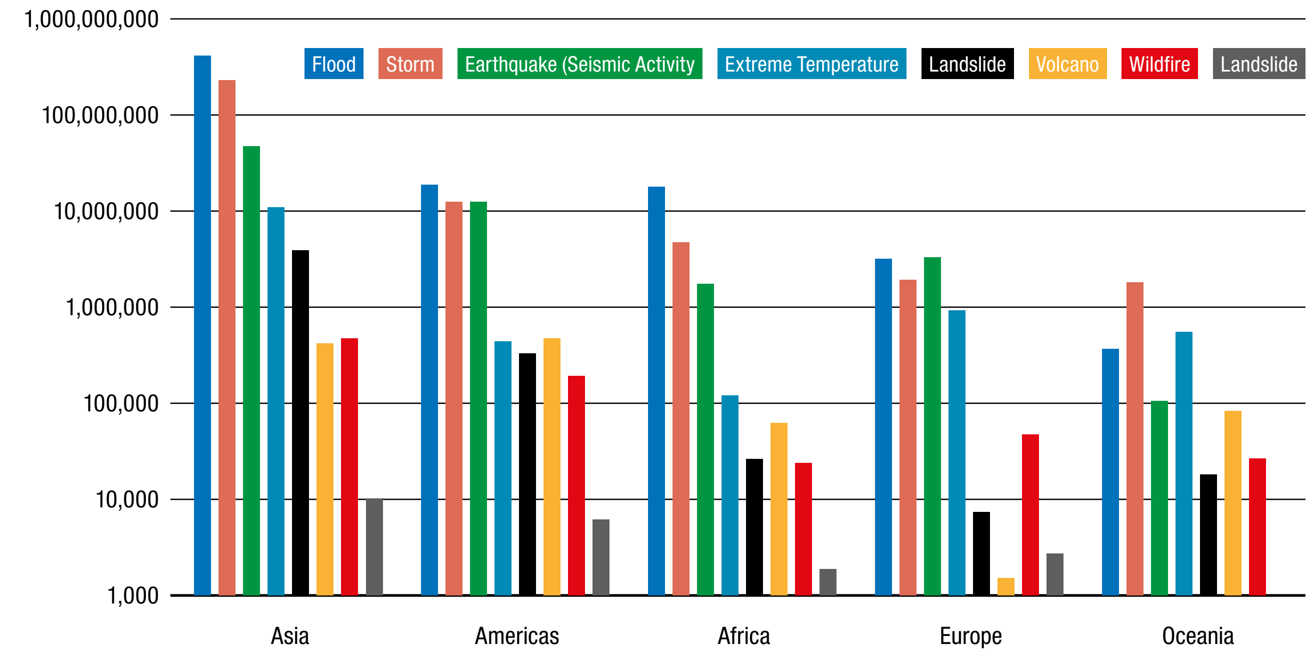
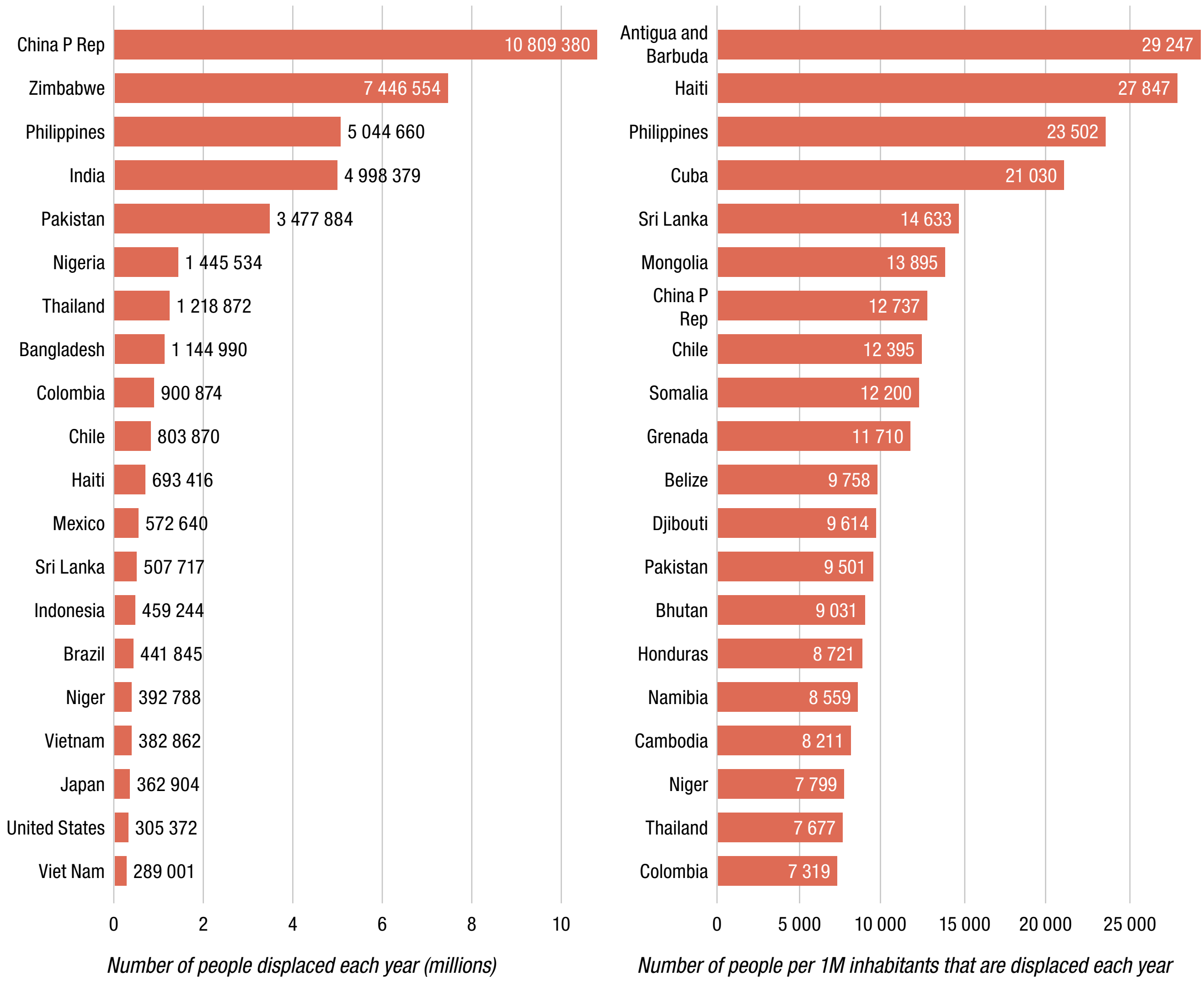


Figure 2.10: Average annual displacement risk based on data from 1994-2003

a. Average historic displacement

b. Relative historic displacement
(displaced per 1 million people)



storms, earthquakes, extreme temperatures, wet and dry landslides and wildfires (Figure 2.9) than people in any other region. Ten times as many people have been displaced in Asian than in the regions that rank second in terms of the number of people displaced per type of hazard.[28]

Over the past 20 years, the countries with the highest absolute displacement risk have all been located in Asia. This also reflects the very large exposed and vulnerable populations within the region (Figure 2.10a). When population size is taken into consideration, however, the data tell a slightly different story. Asian countries are still well represented but a number of smaller countries, including small island states, appear on the list (Figure 2.10b).

The relative displacement risk figure estimates underscore the particular vulnerability of small island states in which a large proportion of the country's population may be exposed to the same hazard. Such states effectively concentrate displacement risk due to their size, location and topography. Thus, when a disaster occurs it has the potential to affect most or all of a country. Antigua and Barbuda, Haiti and Cuba are all small island states with populations regularly exposed to hazards.

2.3 FUTURE DISPLACEMENT RISK

2.3.1 Disaster Displacement Risk Index (DDRI)

Most of the analysis provided in this section has thus far focused on historic displacement estimates and historic displacement risk. This historic information becomes more valuable by enabling IDMC to estimate future displacement risk. Measuring future risk may in turn help governments and others address the underlying sources of risk rather than addressing displacement only after it occurs.

In order to help categorise future displacement risk, IDMC has established a Disaster Displacement Risk Index (DDRI), which projects expected average annual displacement per country and per hazard type for the next ten years (Table 2.2). These projections assume a 'business as usual' scenario in which natural hazards occur with the same frequency and intensity as in the past and population growth and changes in exposure and vulnerability occur at current rates. Based upon the historical data and these assumptions about the next decade, IDMC has found that:

- displacement risk will continue to increase, particularly in countries in South Asia (by 3.7 per cent) and South-east Asia (2.4 per cent)
- in South and South-east Asia, displacement risk will continue to increase at a faster rate than the population is growing and
- after accounting for population, people in South-east Asia are nearly three times more likely to be displaced than people in South Asia and almost four times more likely to be displaced than people living in Latin America and the Caribbean.

In terms of countries at risk within the four focus regions, IDMC estimates that Haiti has the highest relative risk, with approximately 22,000 per million Haitians at risk of being displaced per year (Table 2.3). The Philippines is second with approximately 21,000 per million Filipinos at risk per year. Rounding out the top five Tonga (18,000 per million) is third, Samoa (17,000 per million) fourth and China (16,000 per million) is fifth.

Table 2.2: DDRI for focus regions

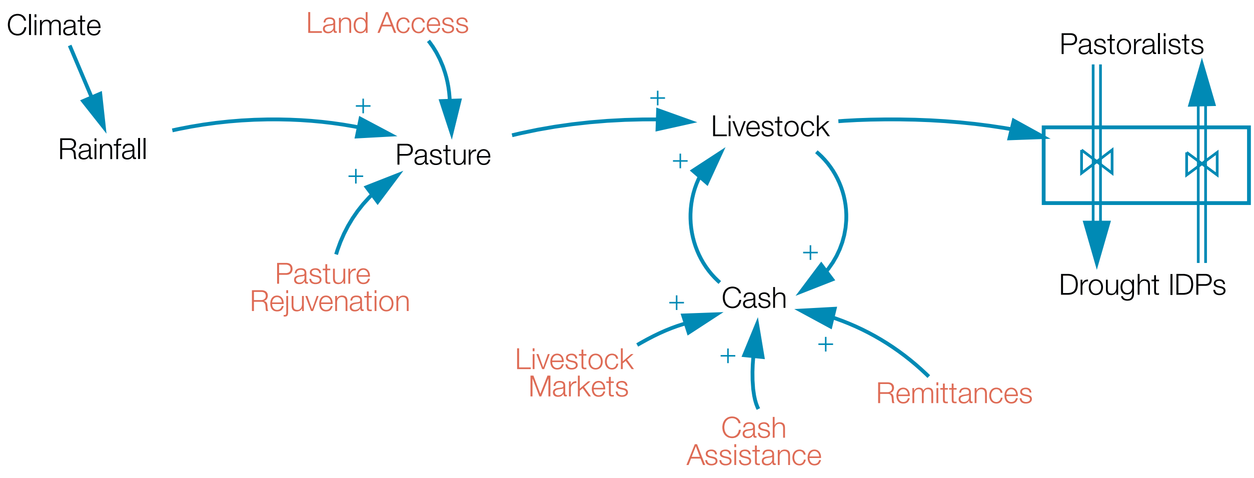
Focus Region	Population	Average Annual Displacement Risk	Relative Annual Displacement (per 1 million people)	Annual change in displacement risk
S Asia	1,730,000,000	9,200,000	5,300	3.7%
SE Asia	1,990,000,000	30,000,000	15,100	2.4%
S Pacific	10,800,000	45,600	4,200	2.4%
LAC	186,000,000	809,000	4,300	2.5%

28 This fact that is somewhat obscured by the logarithmic scale of the Y-axis in Figure 2.9. Each horizontal grid line represents a tenfold increase in terms of the number of people displaced.

Table 2.3: DDRI for countries in the four focus regions

Region	Country	Population	Average Annual Displacement Risk	Reg. Rank	Overall Rank	Relative Annual Displacement (per 1 million people)	Reg. Rank	Overall Rank	10-year change in displacement risk
S Asia	Afghanistan	35 516 224	133 005	6	17	3 745	8	32	10,8%
S Asia	Bangladesh	156 536 136	2 233 996	2	5	14 271	1	6	6,4%
S Asia	Bhutan	829 184	6 135	7	28	7 399	4	19	2,2%
S Asia	India	1 292 502 640	7 686 086	1	4	5 947	6	25	2,5%
S Asia	Maldives	311 724	2 261	8	35	7 254	5	20	2,8%
S Asia	Nepal	32 054 000	133 083	5	16	4 152	7	28	2,4%
S Asia	Pakistan	187 250 400	1 551 406	3	7	8 285	3	15	3,4%
S Asia	Sri Lanka	21 529 024	289 595	4	10	13 451	2	7	3,4%
S Asia		1 726 529 332	12 035 568			6 971			3,4%
SE Asia	Brunei Darussalam	411 448	0	10	52	0	10	52	0,0%
SE Asia	Cambodia	15 041 720	193 928	6	14	12 893	3	9	2,1%
SE Asia	China	1 369 274 688	22 708 910	1	2	16 585	2	5	3,2%
SE Asia	Indonesia	251 306 784	487 685	4	9	1 941	7	39	1,6%
SE Asia	Lao PDR	6 682 752	5 137	9	29	769	8	45	2,7%
SE Asia	Malaysia	30 287 996	11 001	8	26	363	9	46	0,0%
SE Asia	Myanmar	49 608 742	196 485	5	13	3 961	5	30	3,4%
SE Asia	Philippines	100 082 080	2 121 525	2	6	21 198	1	2	11,7%
SE Asia	Singapore	5 511 682	0	10	52	0	10	52	0,0%
SE Asia	Thailand	70 397 688	557 193	3	8	7 915	4	17	1,3%
SE Asia	Vietnam	91 614 198	190 426	7	15	2 079	6	37	0,2%
SE Asia		1 990 219 778	26 472 288			13 301			3,7%
S Pacific	American Samoa	56 000	126	11	41	2 251	12	36	0,7%
S Pacific	Cook Islands	20 000	171	9	39	8 546	6	14	0,8%
S Pacific	Federated States of Micronesia	104 000	86	12	42	823	16	44	0,6%
S Pacific	Fiji	915 462	10 092	2	27	11 024	5	13	0,9%
S Pacific	French Polynesia	258 000	23	14	44	91	19	49	1,4%
S Pacific	Guam	159 000	510	7	37	3 210	9	33	2,1%
S Pacific	Kiribati	103 370	205	8	38	1 981	13	38	2,4%
S Pacific	Marshall Islands	52 000	163	10	40	3 131	10	34	0,0%
S Pacific	Nauru	10 000	0	21	51	44	20	50	4,0%
S Pacific	New Caledonia	246 000	41	13	43	165	17	47	1,5%
S Pacific	Niue	1 000	13	17	47	12 756	3	10	1,4%
S Pacific	Northern Mariana Islands	54 000	8	18	48	144	18	48	3,6%
S Pacific	Palau	20 000	1	20	50	42	21	51	0,2%
S Pacific	Papua New Guinea	7 536 384	17 186	1	25	2 280	11	35	1,1%
S Pacific	Samoa	203 804	3 516	5	34	17 250	2	4	0,4%
S Pacific	Solomon Islands	627 948	3 883	3	31	6 183	8	24	2,2%
S Pacific	Tokelau	1 000	8	19	49	7 754	7	18	2,0%
S Pacific	Tonga	101 202	1 824	6	36	18 021	1	3	1,3%
S Pacific	Tuvalu	10 000	16	15	45	1 627	14	41	0,0%
S Pacific	Vanuatu	314 202	3 537	4	32	11 256	4	11	4,0%
S Pacific	Wallis and Futuna Is	14 000	14	16	46	970	15	43	0,5%
S Pacific		10 807 372	41 421			3 833			1,4%
LAC	Belize	315 402	3 527	10	33	11 182	2	12	0,8%
LAC	Costa Rica	4 940 160	20 284	8	24	4 106	8	29	1,4%
LAC	Dominican Republic	10 478 664	50 443	5	20	4 814	7	27	0,9%
LAC	El Salvador	6 399 540	40 614	6	22	6 346	4	22	1,5%
LAC	Guatemala	15 931 104	91 342	3	18	5 734	6	26	1,5%
LAC	Haiti	10 637 634	232 937	1	11	21 897	1	1	1,3%
LAC	Honduras	8 250 918	65 413	4	19	7 928	3	16	0,6%
LAC	Mexico	119 218 446	220 900	2	12	1 853	9	40	0,4%
LAC	Nicaragua	6 197 160	38 440	7	23	6 203	5	23	1,2%
LAC	Panama	3 724 128	4 518	9	30	1 213	10	42	0,4%
S Pacific		184 815 000	768 419			4 158			1,0%

Figure 2.11: High-level causal diagram of pastoralist displacement dynamics

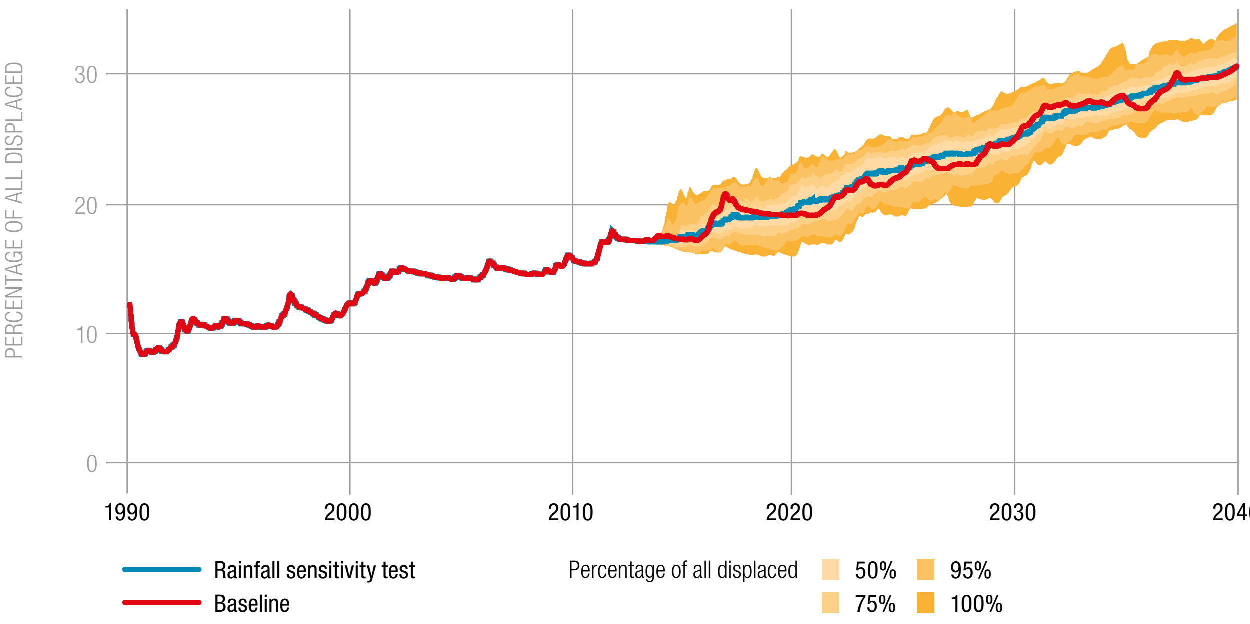


2.4 DISPLACEMENT RISK RELATED TO DROUGHTS AND FLOODS IN THE HORN OF AFRICA

Assessing displacement risk related to slow-onset hazards calls for a different methodology than probabilistic risk assessment. For survivors of sudden-onset hazards, the sequence from hazard event to the displacement outcome is relatively straightforward. For example, earthquake survivors may become displaced if their homes were destroyed or sufficiently damaged. In the context of droughts and other slow-onset hazards, the causality is much more ambiguous due to the nature of the hazard and the numerous intervening human factors that shape people's vulnerability to it.

Thus, in order to account for the complex factors that influence drought-related displacement of pastoral populations in the Horn of Africa, IDMC and Climate Interactive[29] have developed a Pastoralist Livelihood and Displacement Simulator. Using the best available data from climate, environmental and social sciences, it incorporates it into an interactive system dynamics model that reveals the impacts of diverse natural and human factors on the wellbeing and displacement of pastoralists (Figure 2.11).

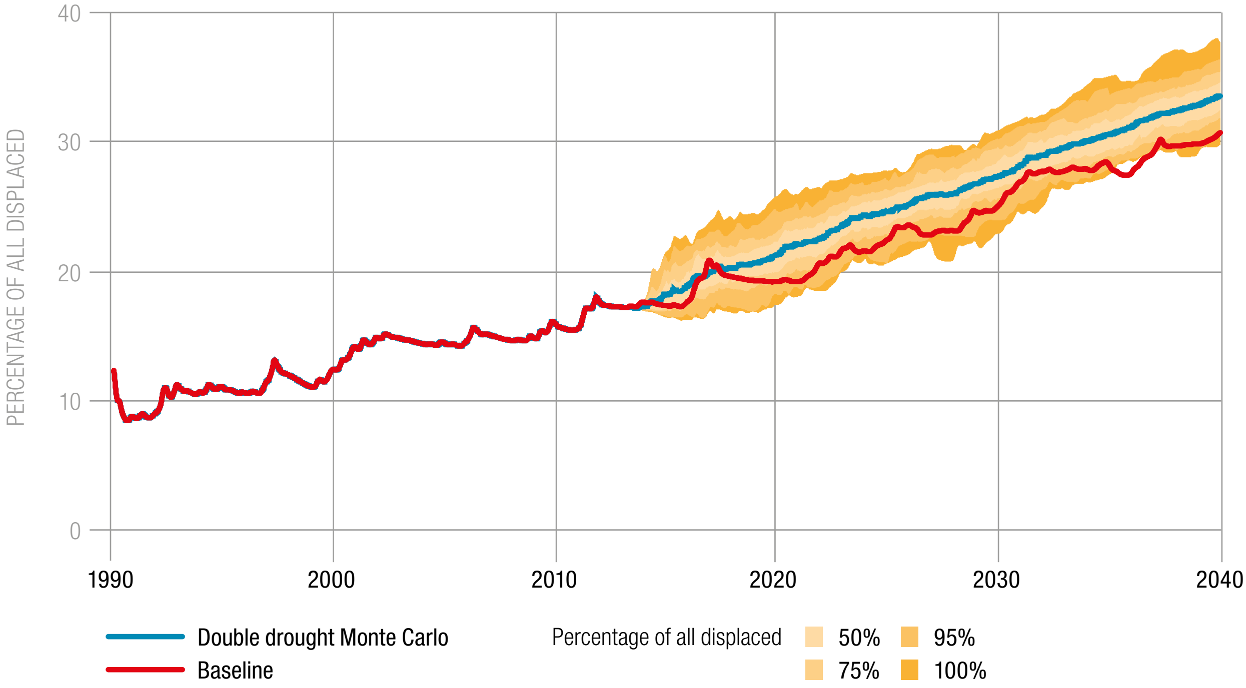
Figure 2.12: Percentage of pastoralist population displaced using Monte Carlo displacement simulation based on 1,000 drought scenarios (1990 – 2040)[30]



[29] For more information about Climate Interactive, see http://www.climateinteractive.org.

[30] In a Monte Carlo simulation the model was simulated 1,000 times using one drought probability. The distribution of these outcomes, when plotted, indicates which scenarios occur with the greatest regularity and which are outliers.

Figure 2.13: Percentage of pastoralist population displaced using Monte Carlo displacement simulation based on 1000 drought scenarios (1990 – 2040) with more frequent future droughts



While pastoralist displacement is affected by social changes, government policies and other forces, the frequency and amount of rainfall is fundamental to a viable pastoralist livelihood. By running a series of Monte Carlo simulations, Figure 2.12 illustrates the range of one thousand different rainfall scenarios given the same baseline probability of drought (i.e., droughts are neither more nor less likely to occur in the future compared to the past).

Even with the same probability of drought – the chance of a drought is the same in all scenarios – there are variations in the level of displacement in the region. This has to do with the timing of any particular drought and how close any two droughts are together. If two droughts occur in relatively quick succession (e.g., one year apart) then more pastoralists would be displaced during the second drought than if the second drought had occurred several years later. The displacement would be higher because the livestock population would not yet have recovered from the first drought when the second drought occurred. Therefore pastoralists would be more vulnerable at the beginning of the second drought. This type of complexity and interdependency is common to all disaster-related displacement scenarios, and this example demonstrates one of the challenges of representing a complex reality in a simplified model.

To explore the importance of rainfall and droughts in the future, IDMC tested a scenario in which the likelihood of a drought occurring in a given year in the future was double the historical probability of drought. As Figure 2.13 shows, the increased probability of drought results in a slightly greater amount of pastoralist displacement compared to the reference scenario. Taken together, these results suggest that for any given future probability of drought it will be the precise timing of droughts and recent history that will largely determine the level of displacement.

3. IDENTIFYING AND ADDRESSING THE DRIVERS OF DISPLACEMENT RISK

This section of the report examines different risk drivers as they relate to the three principal components of disaster risk – hazard, exposure and vulnerability. Impervious to human actions, natural hazards are typically treated as an exogenous component of risk. This assumes that earthquakes, storms and floods of varying magnitude and intensity will occur at different intervals regardless of human actions, although human-induced climate change has forced researchers to revisit this assumption. The other risk drivers discussed in this section of the report relate to factors that are increasing people's exposure to hazards and inhibiting efforts to reduce their vulnerability to these hazards.

3.1 HAZARDS: CLIMATE CHANGE IS A FUTURE RISK DRIVER THAT REMAINS POORLY UNDERSTOOD

Climate change has not been a significant driver of displacement to the present. However, it is expected to become increasingly influential in the coming decades. In its special report on disasters and extreme events, the Intergovernmental Panel on Climate Change (IPCC) found that "Disasters associated with climate extremes influence population mobility. . . . If disasters occur more frequently and/or with greater magnitude, some local areas will become increasingly marginal as places to live or in which to maintain livelihoods. In such cases, migration and displacement could become permanent."[31] More recently, the IPCC noted that "[m]ajor extreme weather events have in the past led to significant population displacement, and changes in the incidence of extreme events will amplify the challenges and risks of such displacement."[32]

As with existing disaster-related displacement risk, urban dwellers face elevated risks associated with the impacts of climate change. Rising sea levels and storm surges, extreme precipitation, inland and coastal flooding, landslides, will pose an increased threat to people, their livelihoods and assets, as well as the ecosystems that protect them. Furthermore, "[t]hese risks are amplified for those who live in informal settlements and in hazardous areas and either lack essential infrastructure and services or where there is inadequate provision for adaptation."[33]

Climate change will influence the character of familiar hazards, and it will increase the risk of relatively uncommon hazards. Glacial lake outburst floods (GLOFs) are relatively rare phenomena, and outside of the Himalayas and Andes they are typically associated with volcanic eruptions.[34] Due to the fact that climate change is increasing the rate at which glaciers are melting, the risk of GLOFS is expected to increase in the future.[35] For example, a recent analysis of three of Nepal's 21 "potentially dangerous" glacial lakes found that at least 3,300 people currently reside inside the flood zones (Table 3.1).[36]

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31 IPCC, 2012, p.16.

32 Adger, W.N., J.M. Pulhin, J. Barnett, G.D. Dabelko, G.K. Hovelsrud, M. Levy, Ú. Oswald Spring, and C.H. Vogel, 2014, Chapter 12: Human security, http://goo.gl/FzPAQb. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge, UK and New York, NY: Cambridge University Press, p. 758.

33 Revi, A., D.E. Satterthwaite, F. Aragón-Durand, J. Corfee-Morlot, R.B.R. Kiunsi, M. Pelling, D.C. Roberts, and W. Solecki, 2014. Chapter 8: Urban areas, http://goo.gl/vlHjRC. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change,* p. 538.

34 These volcano-induced floods known by their Icelandic name, *jökulhlaup.*

35 Dasgupta, P., J.F. Morton, D. Dodman, B. Karapinar, F. Meza, M.G. Rivera-Ferre, A. Toure Sarr, and K.E. Vincent. 2014: Chapter 9: Rural areas, http://goo.gl/Q5cHUr. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change,* pp. 623 and 636.

36 International Centre for Integrated Mountain Development (ICIMOD). 2011. Glacial Lakes and Glacial Lake Outburst Floods in Nepal, http://goo.gl/uR1UcM. Kathmandu, Nepal: ICIMOD.

Table 3.1: Number of households and people exposed to flooding from three of Nepal's glacial lakes (Source: ICIMOD and GFDRR, 2011)

	Number of households located in flood-prone area	Number of people living in flood-prone area
Imja Tsho	360–710	1,928–3,481
Tsho Rolpa	142–331	680–1,604
Thulagi Lake	132–298	700–1,690

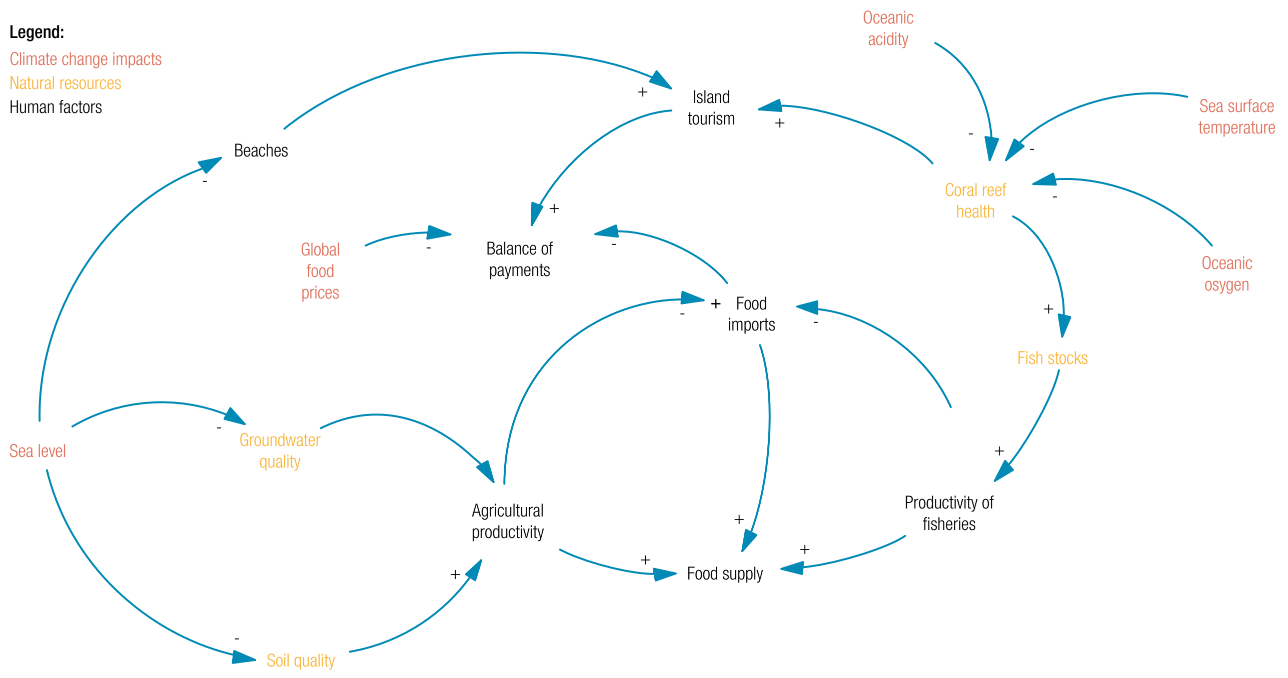
The impacts of climate change are expected to make some areas inhospitable, due to the loss of territory or other factors, by making it more difficult for people to maintain livelihoods and food security. For example, while it is widely recognised that low-lying small island states face a long-term existential threat due to sea-level rise, people in many of these countries are also exposed – and vulnerable to – several other interlocking climate change impacts that may undermine food security (Figure 3.1) and access to drinking water. If these impacts occur in the near to medium term, islanders may be forced from their homelands due to economic hardship or their inability to access food and drinking water rather than the loss of territory.

3.2 EXPOSURE: MORE PEOPLE IN HARM'S WAY

The primary driver of increasing displacement risk is population growth, particularly in hazard-prone areas: the world's population has doubled since 1970, with most of that growth coming in developing countries in Asia and Africa.[37] In its special report on disasters and climate change, the Intergovernmental Panel on Climate Change (IPCC) concluded that "exposure and vulnerability are key determinants of disaster risk and of impacts when risk is realized,"[38] and that disaster impacts in the near future will be driven by changes in exposure and vulnerability.

For the past forty years, exposure has risen most quickly in the most vulnerable countries, and this trend is projected to continue through 2050 (Figure 3.2). If exposure continues to increase, the only way to keep risk in check is to reduce vulnerability. Many of the numerous factors that combine to configure people's vulnerability are related to structural poverty and low human development. This means that sound development plans have the potential to generate co-benefits while improving a country's economic performance.

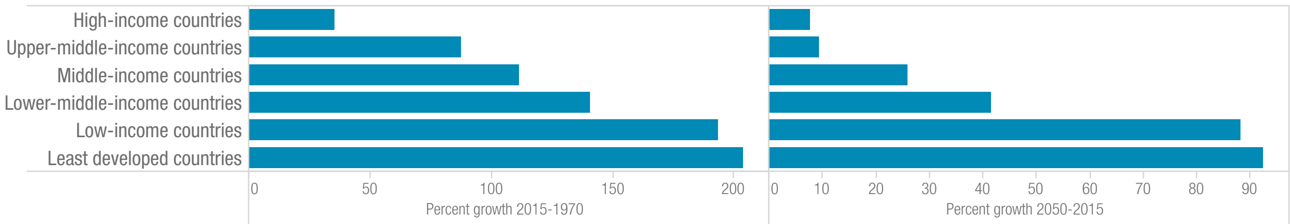
Figure 3.1: Interlocking vulnerability of small island states to climate change impacts on food security



[37] United Nations, Department of Economic and Social Affairs, Population Division. 2014. World Urbanization Prospects: The 2014 Revision, CD-ROM Edition, http://esa.un.org/unpd/wup/default.aspx.

[38] Intergovernmental Panel on Climate Change (IPCC). 2012. "Summary for Policymakers." In: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge, UK, and New York: Cambridge University Press, p.6.

Figure 3.2: Population growth by income group: historical (1970 – 2015), left; projected (2015 – 2050) right



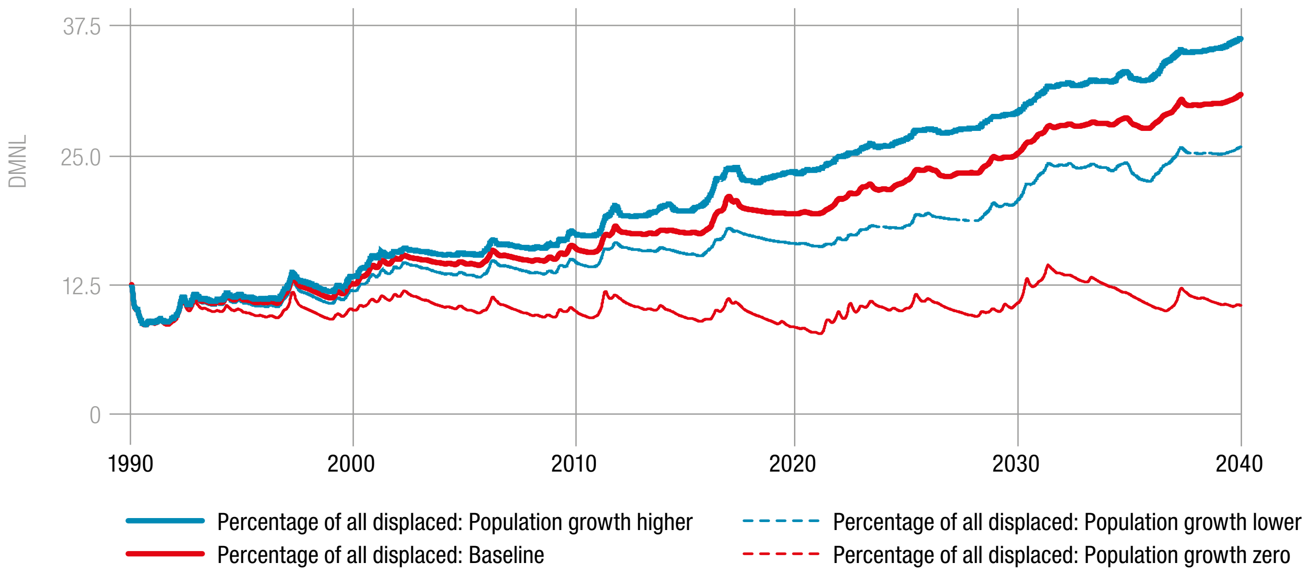
For example, measures that reduce the number of subsistence pastoralists, such as livelihood diversification or slowing the population growth rate, can substantially reduce displacement (Figure 3.3) while also generating additional sources of income and increasing the economic productivity of arid and semi-arid lands. In fact, these policies have a greater impact on pastoralist displacement than changes in the probability of droughts.

3.3 EXPOSURE: RAPID URBAN GROWTH AND POOR URBAN PLANNING

The IPCC has judged that "rapid urbanisation and the growth of megacities, especially in developing countries, have led to the emergence of highly vulnerable urban communities, particularly through informal settlements and inadequate land management,"[39] a dangerous combination of factors that have increased displacement risk.

While highly urbanised populations are associated with economic growth the process of urbanisation can be one of the primary disaster risk drivers if it is unplanned or poorly managed.[40] Cities in low- and middle-income nations often concentrate a large proportion of global urban poverty and vulnerability when the economic base does not generate sufficient employment and livelihoods to sustain a rapidly growing population.[41] In developing countries, one in every three urban residents lives in a slum,[42] and 40 per cent of urban growth currently occurs in slums.[43] Informal settlements combine high exposure with high vulnerability and arise due to the fact that they are often located close to income-earning opportunities but on marginal land that is too dangerous for commercial or housing development.[44]

Figure 3.3: Drought-related displacement (as per cent of pastoralist population) and population-growth scenarios



39 IPCC, 2012, p.8.

40 World Economic Forum, 2015, p.26;

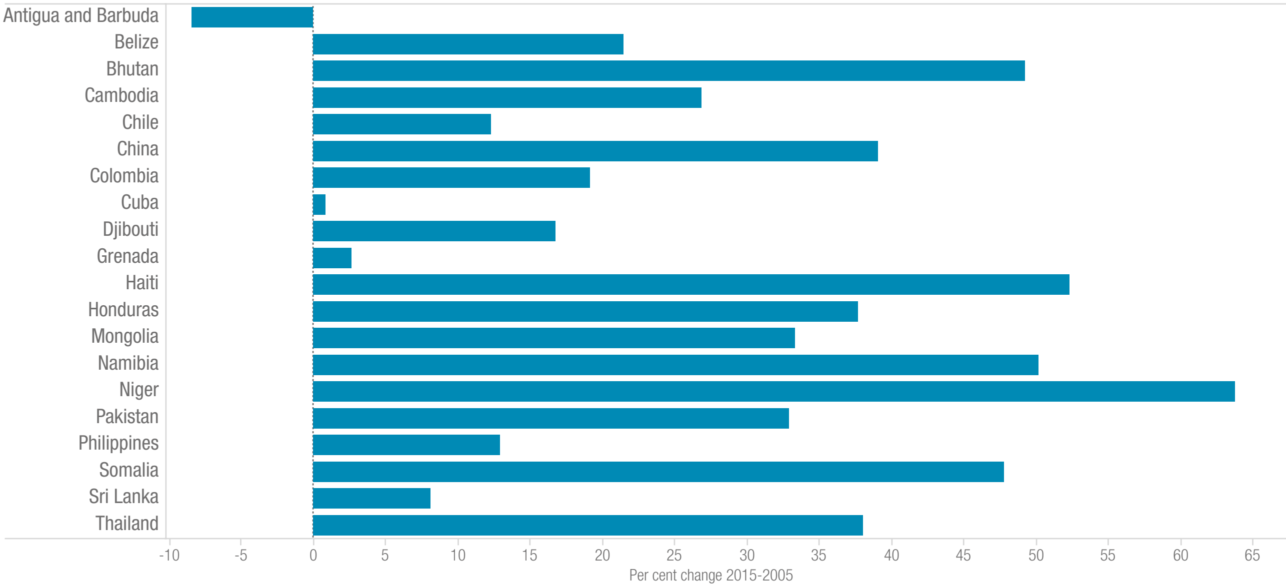
41 UNISDR. 2009. 2009 Global Assessment Report on Disaster Risk Reduction: Risk and poverty in a changing climate, http://goo.gl/OI7s8d. Geneva: UNISDR. p.97.

42 United Nations Human Settlements Programme (UN-HABITAT), 2013. *Global Report on Human Settlements 2013: Planning and Design for Sustainable Urban Mobility,* http://goo.gl/5GZi6a, Nairobi, Kenya: UN-HABITAT.

43 UN WATER, 2014, Thematic factsheets, http://goo.gl/p6p04C. Paris: UN WATER.

44 Mitlin, D., and Satterthwaite, D. 2013. *Urban Poverty in the Global South: Scale and Nature.* London: Routledge.

Figure 3.4: Per cent change in urban population among countries with highest relative risk (per million people) (Source: UN DESA, 2014)



Sum of Per cent change 2015-2005 (Percent Growth (WUP-2014F-03Urban_Population)) for each Country.

Among all forms of disaster risk, rapid, unplanned urbanisation in poor countries is particularly a driver of displacement risk. Among the 20 countries with the highest levels of per capita displacement risk, most have experienced rapid urban growth in the last decade (Figure 3.4). Since 2005, Niger's urban population has grown by 64 per cent, Haiti's by 52 per cent, while those of Bhutan, China, Honduras, Mongolia, Namibia, Pakistan, Somalia and Thailand have all grown by at least 30 per cent.

Rapid urban population growth itself poses a challenge to governments, particularly at the local level. The countries whose urban populations are growing most quickly are not well equipped to address the risk drivers or manage the disaster risks (Figure 3.5). Thus, the risk of being displaced is becoming increasingly concentrated in urban areas within developing countries.

Cities in the Philippines experience large displacement events on an annual basis despite the fact that the country has been recognised as a global leader in enacting legislation related to disaster risk reduction. Margareta Wahlström, the Special Representative of the UN Secretary-General on DRR, has noted that the country's laws on climate change adaptation and DRR are the "best in the world, indicative of a "shift from a react[ive] to a proactive stance in addressing disasters."[45] Its lynchpin is the innovative Philippine Disaster Risk Reduction and Management Act, which was signed into law by then President Macapagal-Arroyo in May 2010.

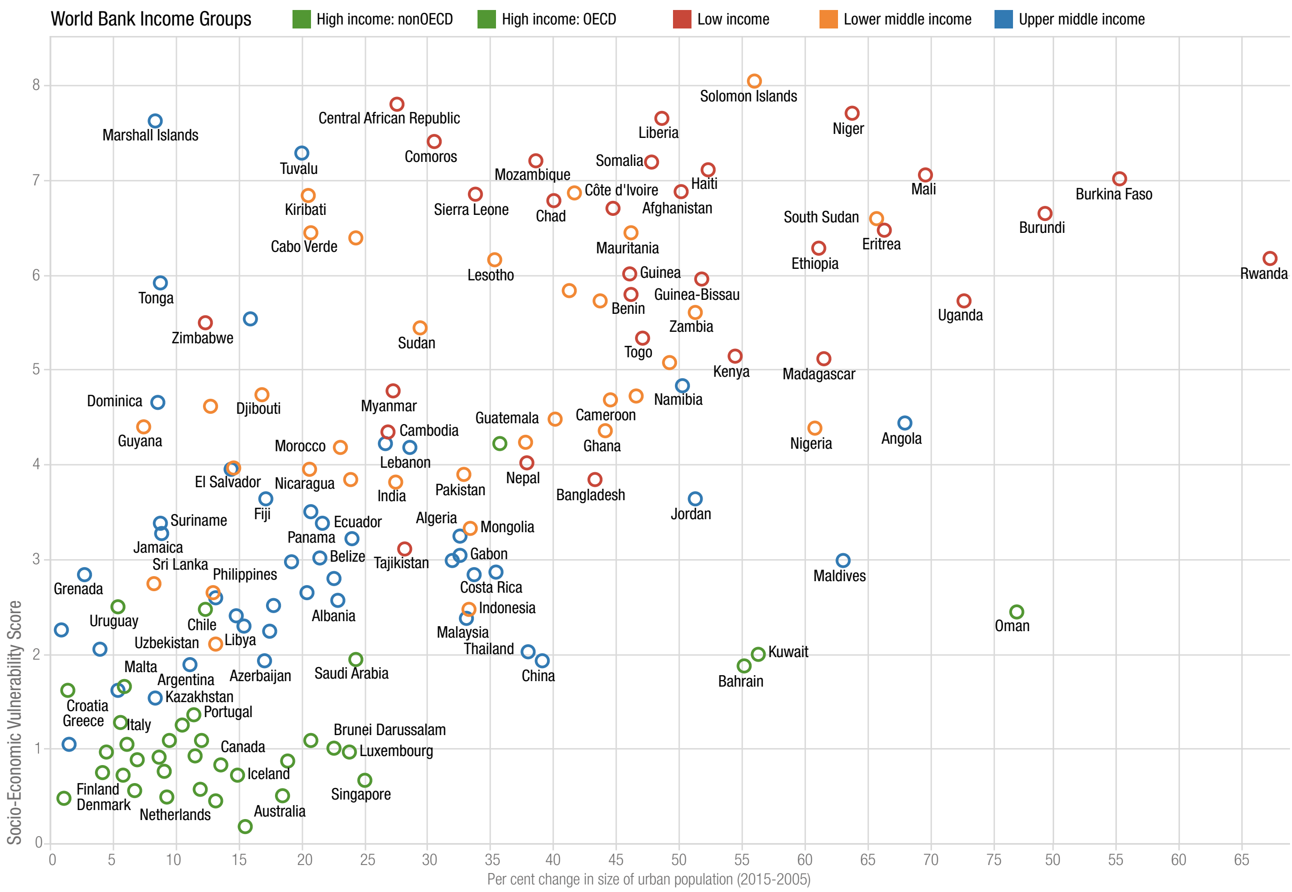
While welcomed as a signal of government intent to move from a paradigm of disaster response to one of risk reduction, the Philippines DRR law has failed to take hold at the local level. In Cagayan de Oro, on the Philippines southern island of Mindanao, the then local government defied federal guidelines that designated parts of the city as 'no build zones' and instead encouraged people to move into them, especially poor rural migrants.[46] Upstream from the city, officials did not enforce mining and logging bans. In September 2011, tropical storm Washi deposited a month's worth of rain in a period of only 24 hours, unleashing a torrent of water, trees and boulders which destroyed bridges, roads and homes, killing more than 1,500 people and displacing 430,900.[47]

[45] Fabe, B. 2013. "Ineffective governance, patronage politics put poor Kagay-anons at risk", http://goo.gl/UwkZ8r, *Mindanao Daily News,* 14 February 2013. p.11

[46] IDMC. 2013. Disaster-induced internal displacement in the Philippines – The case of Tropical Storm Washi/Sendong, http://goo.gl/rzjFQc.

[47] Survivors described it as a riverine "tsunami," ibid.

Figure 3.5: Socio-economic vulnerability and per cent change in size of urban population (2005 – 2015)



Even relatively wealthier nations have trouble managing urban growth. In February 2015, Albania, an upper-middle-income country,[48] confronted the worst flood in decades which forced more than 300 families from their homes.[49] Over the last two decades, many trees close to the Vjosa, Osum and Shkumbin rivers have been chopped down by poor villagers desperate for wood, to clear the way for buildings and dams in a construction boom that has largely benefitted foreign firms.[50] These actions exposed more people to floods and changed the character of the hazard itself. The deforestation reduced the ability of the soil to absorb water and increased the rate of soil erosion and the amount of runoff that made its way into the rivers. Prime Minister Edi Rama attributed the disaster not to the heavy rainfall but to these human factors: "We have an organic problem that is inherited because of soil erosion, deforestation and bad management of rivers. We could have very bad surprises. The dam reservoirs are old and have not been maintained. This is where the most dangerous part of this scenario is."[51]

3.4 VULNERABILITY: UNEQUAL DISTRIBUTION OF VULNERABILITY AND RISK GOVERNANCE CAPACITIES

Low economic development is correlated with vulnerability to hazards. Often those most vulnerable to hazards are the least capable of reducing their exposure (Figure 3.6). Afghanistan, the Central African Republic, the Democratic Republic of Congo and Somalia are among the most vulnerable and they have the least capacity to address risks. They are all currently affected by conflict, another driver of displacement.

DRR financing is heavily concentrated in relatively few, mostly middle-income countries.[52] Consequently, poor countries have a harder time managing their disaster risks due to the fact that the poor have fewer options from which to choose (Figure 3.7). Insuring homes from fire, flood and storm damage is a common way to mit-

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48 Based upon the World Bank's 2014 classification.

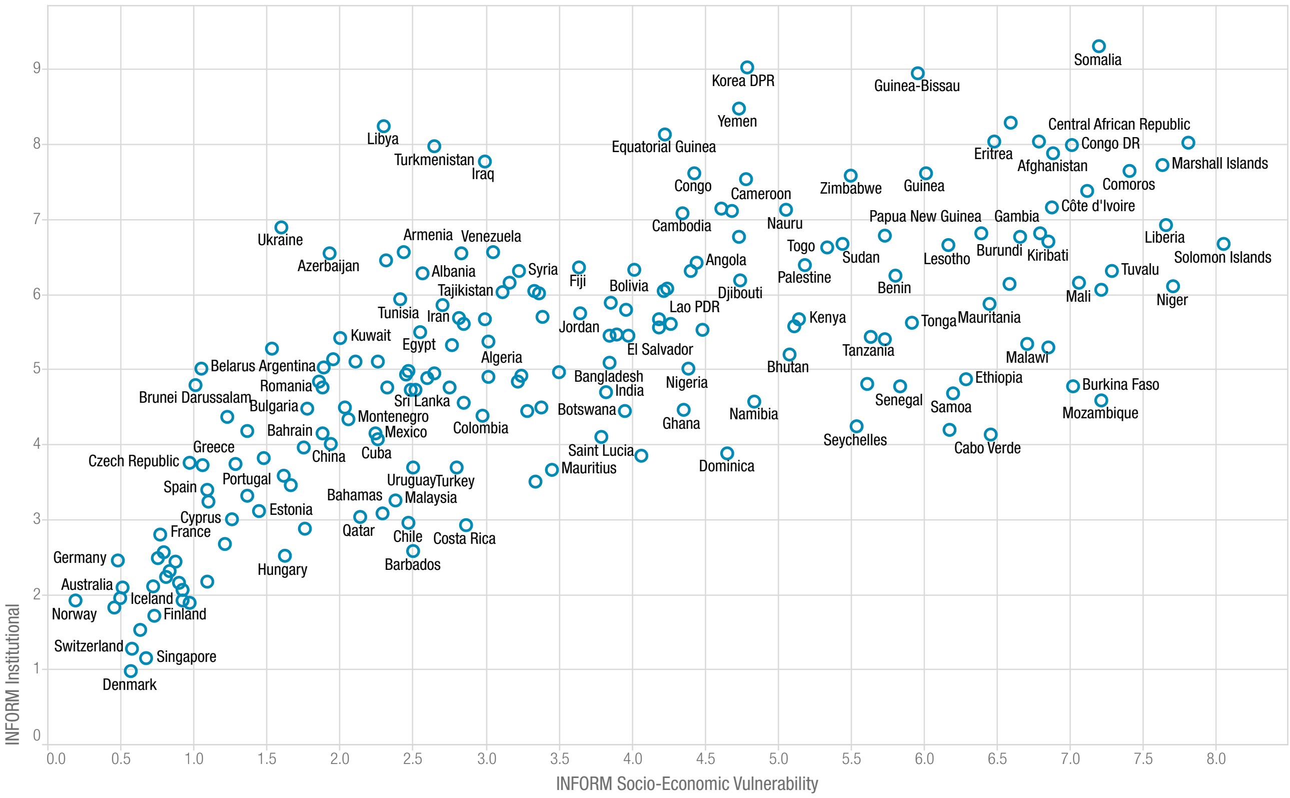
49 Tirana Times. 2015. "Floods Continue to Wreak Havoc", http://tiranatimes.com/?p=1048, *Tirana Times,* 3 February 2015.

50 Nelsen, A. 2015. "Albania Floods Made Worse by Deforestation, Prime Minister Says", http://goo.gl/m5l2ej. *The Guardian.* 5 February 2015.

51 *Ibid.*

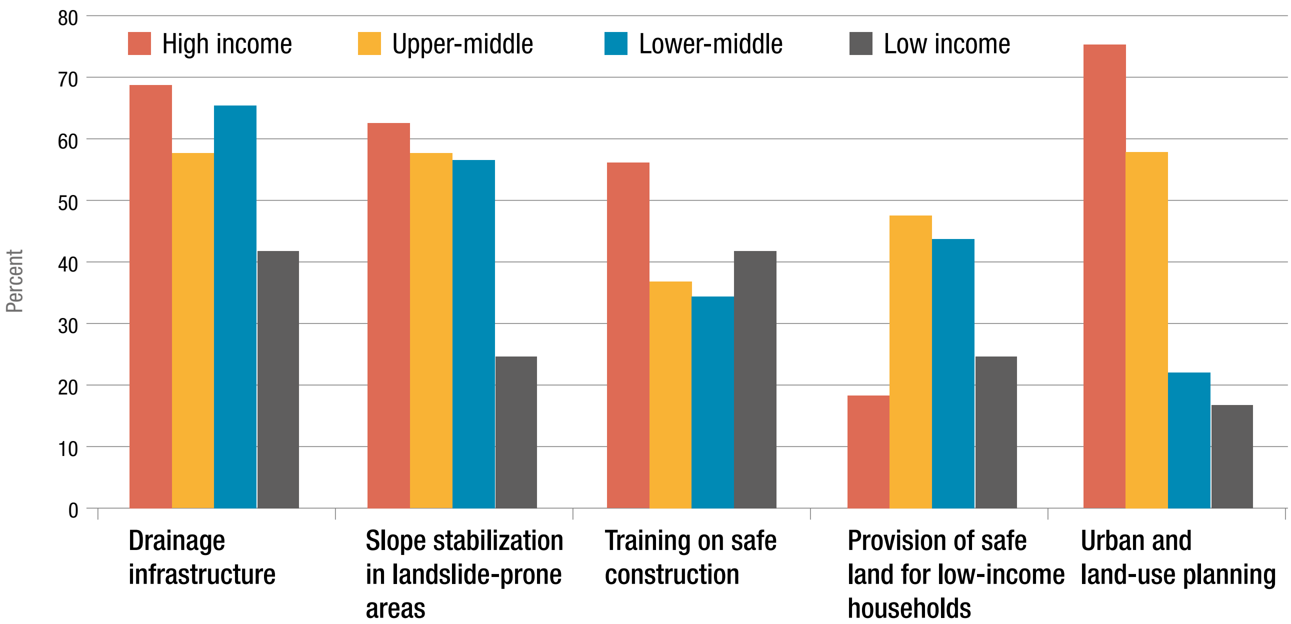
52 Kellett, J., and A. Caravani. 2013. *Financing Disaster Risk Reduction: A 20-Year Story of Financing International Aid,* http://goo.gl/Toh88h. London and Washington, DC: Overseas Development Institute and the Global Facility for Disaster Reduction and Recovery.

Figure 3.6: Vulnerability and lack of risk governance capacities (Source: INFORM, 2014)



Sum of INFORM Socio-Economic Vulnerability vs. sum of INFORM Institutional. The marks are labeled by COUNTRY (Lack of Coping Capacity). Details are shown for Country.
The view is filtered on COUNTRY (Lack of Coping Capacity), which excludes Null.

Figure 3.7: DRR spending by income category in Asia (Source: Jha and Stanton-Geddes, 2013)



igate displacement in high-income countries, but comparable insurance markets do no exist for those living in informal settlements and would not be an attractive option where tenure is not secure. Indeed, those living in informal settlements are beyond the reach of risk-reducing infrastructure or services.[53]

The unequal distribution of wealth is also a problem within countries, even wealthy countries like the United States. This fact was borne out by the disproportionate number of poor residents of New Orleans who were displaced—many for years—in relation to Hurricane Katrina. The 2010 census revealed that New Orleans' population had shrunk by 140,845 (a loss of 29.1 per cent of the city's population) since 2000, and that the depopulation of the city itself was larger than that of the entire metropolitan area, whose population decreased by only 9 per cent.[54]

Prior to Hurricane Katrina, the population of New Orleans had been gradually decreasing since its peak in the 1960s, so not all of the population loss between 2000 and 2010 was due to that one disaster. However, an analysis of U.S. census data reveals that poor African-American families were disproportionately displaced, most famously within the city's Lower Ninth Ward (Figure 3.8). "The most vulnerable populations in New Orleans – the elderly, people with physical and mental disabilities, and single mothers out of the labor market – arguably were hit hardest by Katrina. These groups had the highest poverty rates and the fewest assets. Most were African-American ... Most of these vulnerable residents eventually evacuated the city, and it is unclear how many will return home."[55]

3.5 VULNERABILITY: CONFLICT MAKES PEOPLE MORE VULNERABLE

Conflict can inhibit governments' ability to enforce building codes, zoning guidelines and land-use plans, thus increasing communities' exposure and vulnerability to hazards and increasing their displacement risk. This effect is particularly pronounced in areas controlled by other armed groups. In these instances the conflict not only increases the displacement risk, it can also inhibit the delivery of assistance to people when they are displaced. Thus, it is a concern that 11 of the 20 countries with the highest per capita displacement risk from 1993 to the present have also experienced armed conflict during this period.[56] Five of these states (Somalia, Haiti, Pakistan, Sri Lanka and Niger) are classified as "alert," "high alert" or "very high alert" in terms of state fragility.[57]

Conflicts and natural hazards can cause displacement in the same time and place. For pastoralists in the Horn of Africa, the impacts of drought and conflict often mingle and amplify one another (Figure 3.9). Cattle rustling, for example, is one response to drought among pastoralists. Inter-clan conflicts and the presence of armed groups can also inhibit pastoralists' ability to move their animals to grazing areas, making pastoralists and their livestock more vulnerable to droughts.

These effects were visible in September 2008, when UNHCR reported 27,000 people displaced in relation to drought and more than 60,000 people displaced in relation to conflict and insecurity (Figure 3.10). During the 2010–2011 drought, tens of thousands of people were displaced due to the impacts of conflict, overlapping with the waves of those displaced in relation to the drought. Figure 3.10 also reveals that unless the conflict in Somalia ends or is brought under control, pastoralists will remain vulnerable to droughts and risk being displaced.

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53 Mitlin and Satterthwaite, 2013.

54 U.S. Census Bureau, Population Division, 2010, Table 1. Annual Estimates of the Population of Metropolitan and Micropolitan Statistical Areas: April 1, 2000 to July 1, 2009 (CBSA-EST2009-01), http://goo.gl/9Hpspb. Washington, DC: U.S. Census Bureau.

55 Zedlewski, S.R. 2010. Building a Better Safety Net for the New New Orleans, http://www.urban.org/UploadedPDF/900922_safety_net.pdf. Washington, DC: The Urban Institute, p.1.

56 These countries were included in the Uppsala Conflict Data Program (UCDP)/Peace Research Institute Oslo (PRIO) armed conflict database, with armed conflict defined as "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths."

57 The Fund for Peace, 2014, Fragile States Index (FSI) 2014, http://ffp.statesindex.org/rankings-2014. Washington, DC: The Fund for Peace.

Figure 3.8: Population change in New Orleans (2000–2010) (Source: U.S. Census Bureau (data); New York Times (map))

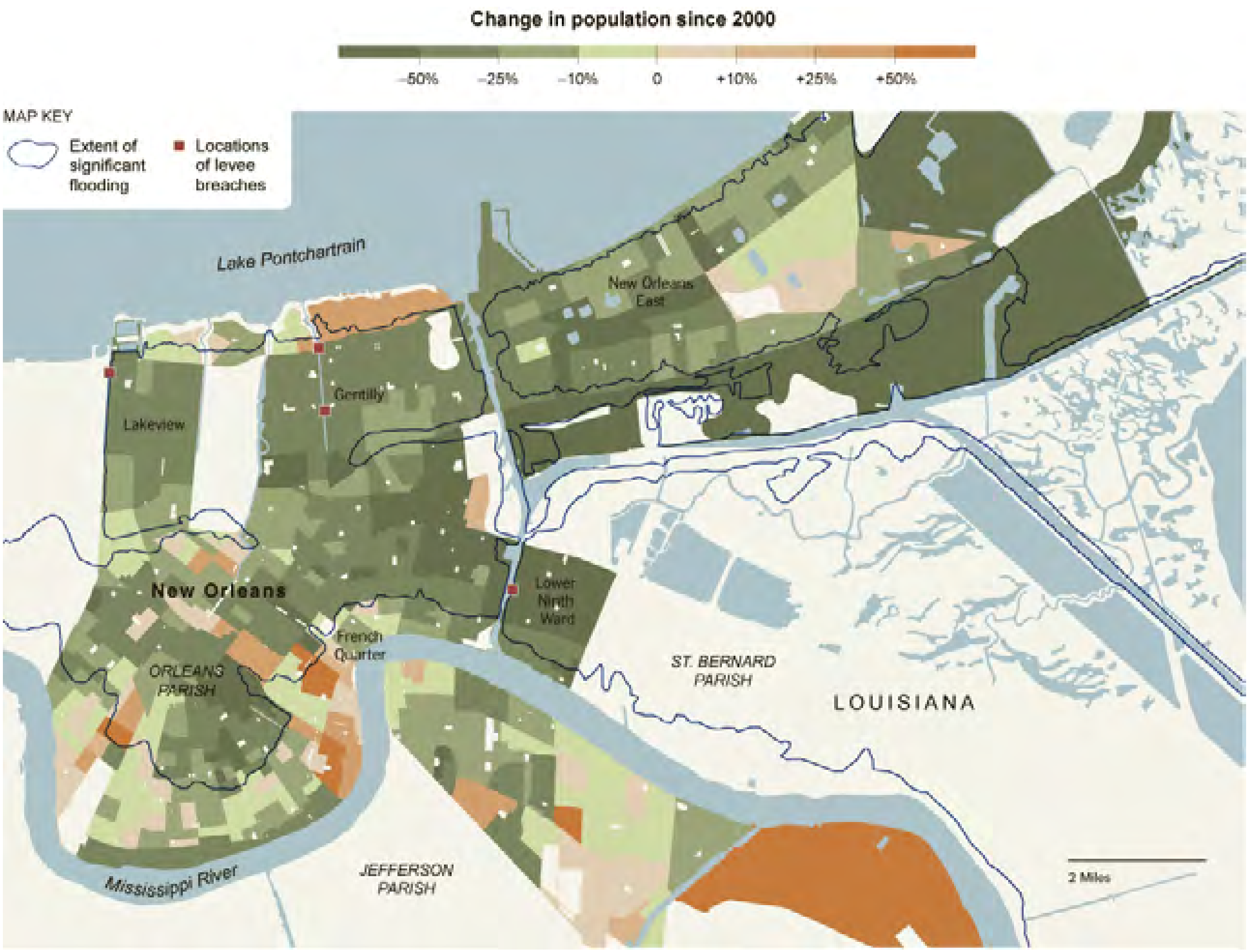


Figure 3.9: High-level causal diagram illustrating the compounded impacts of drought and conflict on pastoralist livelihoods and displacement

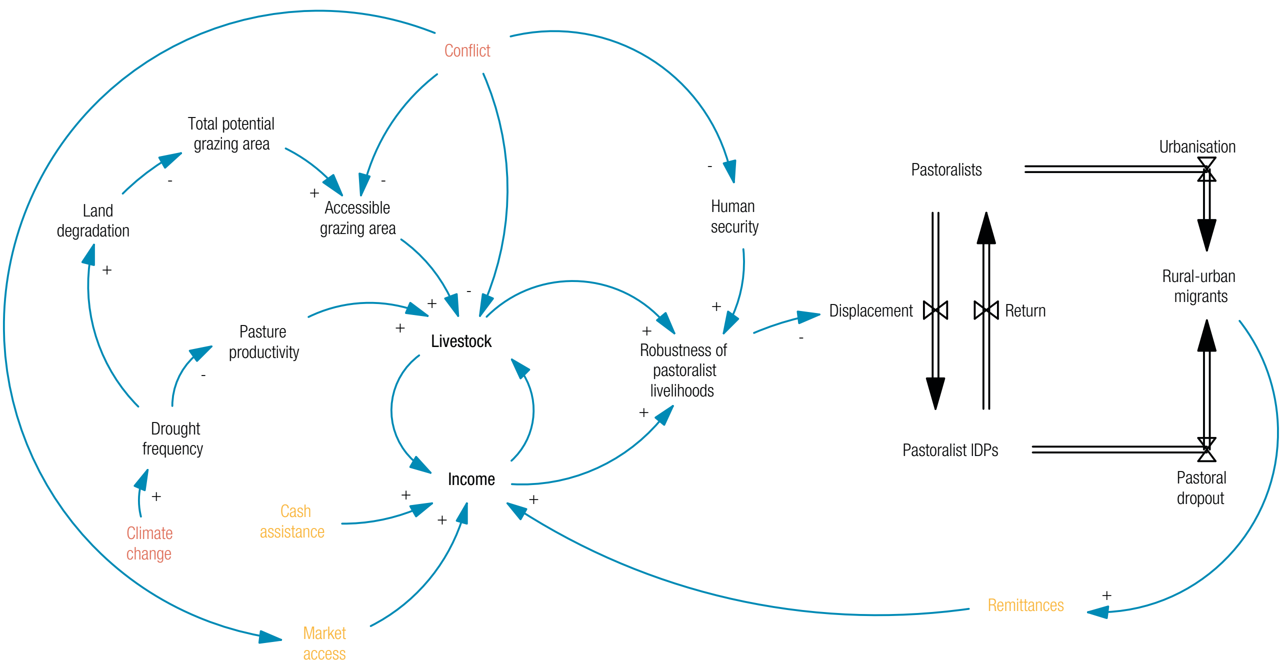
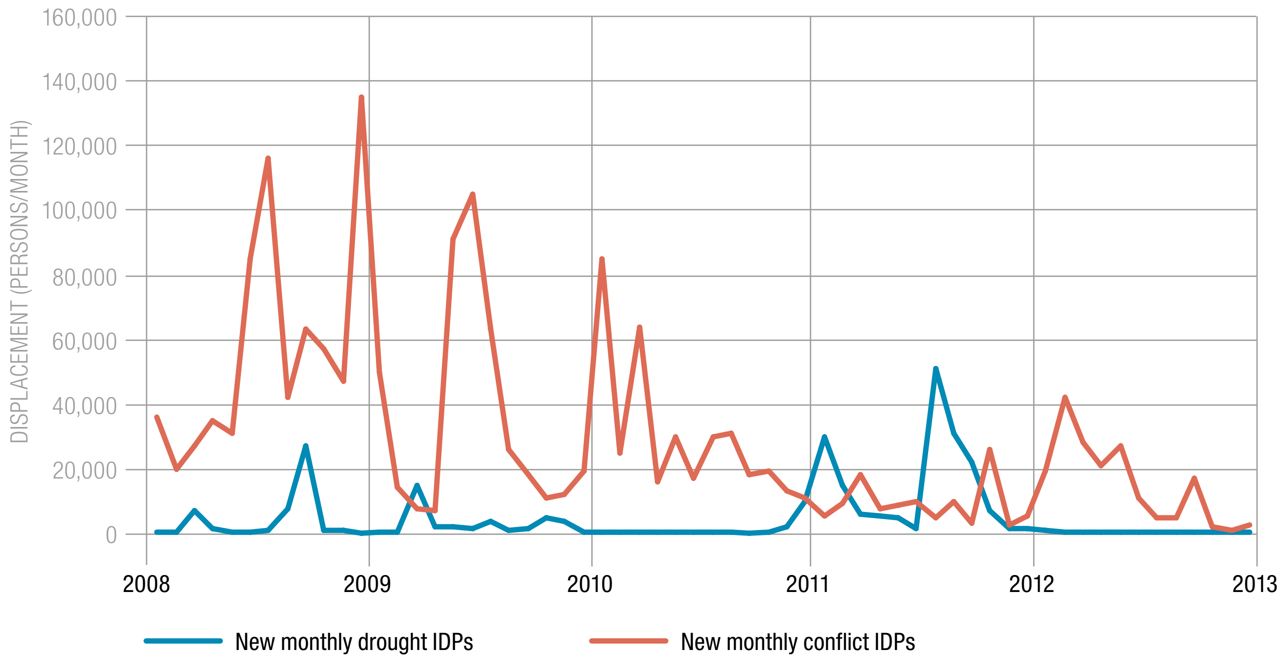


Figure 3.10: Internal displacement related to drought and conflict in Somalia (2008–2013) (Source: UNHCR)



4. CONCLUSION

4.1 COORDINATE POLICY FRAMEWORKS AT MULTIPLE SCALES

This report focused on the risk of disaster-related displacement. Isolating displacement risk helped reveal the scale of this urgent and growing problem. It indicated where the threat of displacement is largest – and to whom. The emphasis on displacement as a particular disaster risk allowed us to unpack it and understand it more thoroughly.

To focus on displacement and exclude other disaster risks is, however, to make a false distinction. The disaster is not the number of people killed or injured, the magnitude of the economic losses, the disruption of livelihoods or the scale of displacement. The disaster is all of these things together. Patterns of displacement represent how people have responded to the hazard and its impacts on homes, lives and livelihoods. **Therefore, many of the measures that can reduce disaster risk in general can also reduce displacement risk in particular.** Live-saving evacuations are one notable exception to this rule.

Bearing this in mind, it is no surprise that IDMC's analysis of displacement risk produced evidence that pointed to the familiar set of risk drivers that are responsible for increasing exposure of vulnerable people and communities: population growth, rapid and unplanned urbanisation, wealth disparities between and within countries, conflict and state failure and the looming threat of climate change.

Each of these problems is large individually, and collectively they may appear to be insurmountable. Tackling these challenges in a coherent and coordinated manner is likely the most effective way to gain traction at the scale required. Fortunately, several opportunities are at hand to set the broad group of stakeholders onto the right paths: the finalisation and adoption of the successor to the HFA; the anticipated agreements on climate change mitigation and adaptation at the UNFCCC's Conference of the Parties in Paris; the new Sustainable Development Goals and the World Humanitarian Summit. Displacement is one bridge across all of these policy forums – it is the human face of them. Coordinated efforts, coherent standards, objectives and indicators among these global processes will provide the necessary momentum to reduce the human impacts that governments are striving to avoid.

4.2 ADDRESS EVIDENCE AND KNOWLEDGE GAPS TO INFORM DRR, DEVELOPMENT AND CLIMATE CHANGE ADAPTATION PLANS

There are a number of practical steps that can be taken to measure, manage and reduce displacement risk through DRR, climate change adaptation and development during 2015 and carried forward into the future. National and global disaster loss databases can be improved by including specific indicators that track the magnitude and duration of disaster-related displacement as it evolves over time. This will help establish a more comprehensive baseline record of displacement which will improve efforts to measure the risk of its future occurrence.

Certain important knowledge gaps also need to be filled in partnership with vulnerable communities. Improved understanding of vulnerability at the local level will help reveal the factors, thresholds and tipping points that trigger displacement, particularly those associated with slow-onset events. This evidence base will explain when and why people abandon, or are not able to rebuild, their livelihoods and the processes through which areas may become uninhabitable. This new knowledge can inform DRR and climate change adaptation measures that aim to make livelihoods more resilient to future hazards.

Research on the protracted displacement and the needs of people who have been displaced is also needed. Displacement itself can make people vulnerable to future hazards, especially for those living in temporary shelters, those without official documents and those without access to livelihood opportunities, food, water and health services. A better understanding of these causal pathways facilitate the inclusion of DRR measures into disaster response so that affected communities can 'build back better' when disasters occur.

Lastly, policymakers can leverage decision-support tools that enable them to explore risk scenarios and the test the effectiveness of plans and policies before deciding which to implement. By incorporating myriad factors and spanning multiple time horizons, such tools can facilitate joint development, DRR and climate change adaptation planning. Where these tools are not yet available, they responsible authorities can demand them.

Regardless of the specific wording of decisions adopted by governments at the global DRR, climate change and development summits, these are steps that can support implementation of these agreements – and reduce the risk of future displacement.

ANNEX: METHODOLOGY

INTRODUCTION

IDMC is working in several ways to increase understanding of disaster related displacement. Since 2008, IDMC has tracked disaster related displacement by hand-screening disaster event data to create high-quality displacement estimates. In 2013, work commenced on modelling future displacement risk. In 2014, modelled historic displacement estimates were introduced to estimate historic risk for a much wider range of years, 1970 to 2012. All of these approaches help to better inform the state of disaster related displacement risk throughout the world. Each approach has particular strengths and weaknesses that together help paint a more complete picture of disaster-related displacement.

The historic modelled displacement and displacement risk figures have been broken down into the following units of analysis:

- global
- regional (Latin America and the Caribbean, Southeast Asia, South Asia and the Horn of Africa)
- national

With the exception of the Horn of Africa, the global, regional and national displacement risk estimates are based upon a probabilistic risk model similar to the one used throughout the 2015 GAR and its predecessors. Due to the complex causality and time scale, drought-related displacement risk in the Horn of Africa was calculated using a system dynamics model.

DISPLACEMENT RISK ASSOCIATED WITH SUDDEN-ONSET HAZARDS: USING HISTORIC DISPLACEMENT ESTIMATES

IDMC's DiDD, annual disaster displacement estimate database for 2008-2013 has been augmented with historic modelled displacement estimates created by using existing disaster loss data from 1970 to 2012. These modelled displacement figures are provided on a country/year/event type basis, and, where possible, also at a sub-national resolution. They have been constructed as analogs to the actuarial concept of AAL (Average Annual Loss, or Average Annual Displacement in this case). These figures are also carried forward as risk estimates for 2015-2020.

Loss data for this analysis was obtained from EM-DAT and DesInventar disaster loss databases, and was then used to create synthetic displacement estimates for 1970-2012, broken down by country and hazard type. The estimates rely on what are considered the strongest loss data categories in these databases (deaths, homeless and people affected variables).

The calibration process involved comparing disaster loss data with IDMC's DiDD displacement estimates for 2008-2012 where a country-by-country comparison was possible. The loss variables were used in linear equations using weightings obtained from regression models for each individual hazard type for which sufficient data was available, and using a generic weighting for the remainder of hazard types.

The goal of this analysis has been to provide a historic context for displacement since IDMC's individually collected and screened DiDD human displacement dataset on specific events only covers events since 2008. With a longer term, four-decade sample, underlying trends in human displacement that are not visible in IDMC's DiDD can thus be explored. This helps to better put recent displacement figures in context as part of longer-term trends and the intrinsic high levels of inter-annual variability that are necessarily part of the nature of events with long return periods.

As a first iteration of this approach, the modelled displacement estimates have provided some validation of expected patterns, shed light on some interesting relationships between datasets and trends and provided opportunities for improving our analysis and understanding of displacement patterns for future reports, both in terms of underlying data and modelling methodology.

CREATING DISPLACEMENT RISK ESTIMATES

Annual AAL figures for 1970-2013 were also carried forward for the period 2015-2025 as average annual displacement risk estimates. The historic modelled displacement figures were then used in combination with the DiDD and some key demographic variables to produce graphs expressing the probability of any particular level of displacement per year, similar to the actuarial concept of MPL (Maximum Probable Loss, or Maximum Probable Displacement in this case). These calculations uses the entire date range of the dataset. This, naturally, poses some problems in terms of comparability as underlying risk drivers, development patterns, population levels and demographics can all change substantially within that period. It is for this reason that Maximum Probable Displacement only loosely follows the actuarial formula for MPL.

AAL and MPL figures have been calculated on a country/event type basis for countries and event types containing sufficient data to run the model, and using generic event types or merged country groupings where sample sizes were too small for a more granular analysis.

RATIONALE

Together with the historical modelled displacement, the DiDD has undergone significant improvements in terms of data normalisation and standardisation . This has significantly increased the type and quality of analytics that can be run on the data. Together with these improvements to the structure of the dataset, there has also been a substantial push to increase the coverage and background information collected for displacement events, providing a richer picture of displacement, and thus informing the calibration process. Furthermore, a similar data structure was employed in the long-term 1970-2012 dataset, extending the analytical capacities and thus enabling direct comparison between the two datasets.

It is important to note that human displacement is almost always measured via either direct or indirect proxies. For example, evacuation figures, people living in temporary camps and homes destroyed are all valuable proxies for determining displacement levels. There is a sliding scale in terms of the usefulness of these proxies. Some of them directly map onto displacement, while others provide only a loose idea of what displacement may have occurred. The different available datasets all carry differing levels of quality, methodological challenges and coverage that must be taken into account when using them.

IDMC's 2008-2013 database of high-resolution displacement estimates relies only on the highest quality and most directly relevant proxies. Close attention is paid to which proxy takes precedence if only one is used for the estimate, or if a combination of several proxies is used. Then the figures are combined to reach the total displacement estimate for that event. Such high quality, directly mapped proxies are not readily available for longer-term analyses. Thus, longer-term analyses must necessarily be limited to the best, closest proxies that are readily available for all countries and all tracked event types (for example, drought is excluded from this list due to this same issue). The most common data collected for disasters that meets these criteria on a historic basis consists of mortality, homeless and affected people totals.

At a global level, the most thorough and most cited database of disaster losses that tracks these variables is EM-DAT. At a national level, the expanding series of disaster loss databases following the DesInventar methodology provide disaggregated loss figures per jurisdiction. Due to the fact that each DesInventar database is administered by each participating country, there are slight variations in structure and more significant variations in coverage and low-end thresholds for inclusion. In the past this has made inter-country comparison difficult. In 2015 IDMC is going to use the ISDR's GAR data universe, which has been pre-screened to insure the highest level of inter-country comparison, thus largely removing this substantial limitation to previous DesInventar datasets.

In all of these datasets, mortality data is of the highest quality, while homeless and affected population information can be somewhat less accurate, especially for some particular types of hazard. Homeless data appears to be most accurately represented in earthquake events, and least well tracked in flood events. Storms and floods have both the highest number of entries and total in terms of mortality and homelessness, which makes their individual hazard analyses rather more robust due to the larger sample sizes.

Landslides, and smaller events in general, receive substantially less attention due to a combination of difficulty in collecting data on so many events and problems that can arise from a change in methodology. These can include a lowering of thresholds for inclusion, that would drastically increase the number of entries for these types of events. For example, EM-DAT utilises a threshold of ten deaths or 100 people affected. Thus, events that are included could be biased toward those in which one or both of these metrics are provided, and biased against events where the particular type of loss is homes or livelihoods. Such variability is present across hazards, loss metrics and different databases, making analysis challenging due to the many sources of confounding.

THE CALIBRATION MODEL

In order to link the two datasets, the loss-based model was calibrated utilising the DiDD dataset by creating a dataset of overlapping country, hazard and year totals between the two datasets. Three iterations of this process were run, seeking to improve the predictive capabilities and reduce sources of uncertainty in the results.

- The first displacement model based on EM-DAT disaster loss data utilised a naive multiplier across all hazard types. This had the benefit of providing a rough estimate without any significant variance related issues, but also without a high degree of fit with underlying hazard/country/year data.

- The second model utilised per-hazard type regression coefficients, where possible, and generic values for hazard types with limited samples.

- The third model sought to reduce some of the biggest challenges raised in the second model by utilising relative values and increasing the sample size.

Each hazard displacement model was calibrated utilizing coefficients obtained from regression analyses between IDMC's annual displacement totals by country and year (2008-2012) and equivalent annual EM-DAT mortality, affected and homeless annual country data. For most hazard types, these regressions were run with that specific hazard type's data. For hazard types with limited data (for example, dry landslides) values were obtained from the regression analysis including all IDMC hazard types.

Due to the limited sample sizes, in even the hazard types with the most displacement entries, the variance of the exogenous variables over the 1970-2012 period is much larger than that found in the limited 2008-2012 sample utilised for the regressions. As a result, some entries appeared as extreme outliers that substantially skewed the results. Several approaches were taken to handle the most extreme outliers generated in the second model. First, values were adjusted to relative mortality, affected, homeless and displaced figures (per million inhabitants). Another option that has been considered but not yet implemented is to increase the sample size in the regression analyses by utilising Monte Carlo simulations.

ADDITIONAL WORK IN PROCESS

Once calibrated, the historic displacement estimates were complemented with other types of indicators, including quantitative demographic, social and governance components to further dimension the analysis. Further investigation into causal relationships between underlying risk drivers and human displacement is ongoing at IDMC, utilising the increased analytical capacities of the DiDD and historical modelled displacement.

Several areas of improvement have been contemplated for the next iteration of both the DiDD and the historical modelled displacement. Disaster loss data from EM-DAT was compiled on an annual level, both to keep the size of the dataset within reason and more importantly, to enable year/hazard/country matching between DiDD and the historical dataset, without which calibration of the historic loss data would not be possible. This makes several assumptions about what set of events are covered within each yearly division, and may pose problems with events that overlap the new year date in terms of which year displacement and loss may be ascribed

One suggested improvement to the calibration algorithm for 2016 would be to attempt an event-by-event matching, at least for the top 50 per cent of the entries. Also, as is the case with the DiDD, tracking displacement due to drought and/or other slow-onset hazards is addressed using another model described in the section below. Should a DiDD displacement estimate methodology be implemented for drought, the current model would then be able to calibrate off of this data.

DISPLACEMENT RISK ASSOCIATED WITH SLOW-ONSET HAZARDS: USING A SYSTEM DYNAMICS MODEL

The Pastoralist Livelihood and Displacement Simulator encompasses Garissa, Mandera, Marsabit and Wajir districts of Kenya, the Borena and Liben zones in Ethiopia as well as the Bay and Gedo regions of southern Somalia. It covers the half century from 1990 to 2040 (Figure A.1).

IDMC and Climate Interactive developed the simulator to improve understanding of how drought combined with other factors to influence the livelihood and displacement of pastoralists. The simulator works in real time so that policy-makers, humanitarians and pastoralists themselves can use it to identify the most effective ways to prevent, mitigate and respond to the impacts of droughts. The tool allows people to test how effective policies and interventions would have been had they been implemented during past droughts. It further allows them to explore different future scenarios to see the impacts of policies, interventions and potential changes in climate.

Figure A.1: Areas in Kenya, Ethiopia and Somalia included in the drought-related displacement model

System dynamics is a modelling technique often used to analyse population dynamics and the behaviour of complex systems. After extensive consultation with experts, IDMC concluded that a methodology based on system dynamics modelling represented a scientifically rigorous and useful way to assess and understand displacement associated with droughts or other slow-onset phenomena. A system dynamics-based methodology is able to incorporate the complex interactions between the variables and the feedback loops within the environmental and human systems and would be able to explain how a slow-onset hazard such as a drought could induce a livelihood crisis resulting in displacement (see Figure A.2 below).

System dynamics models also run quickly, on ordinary computers, and so are very useful for quickly testing a range of scenarios, including scenarios about possibly uncertain future conditions such as climate conditions, population trends and policy choices.

CHALLENGES ENCOUNTERED DEVELOPING THE SYSTEM DYNAMICS MODEL

Governments and organisations coping with displacement in the Horn of Africa – now and in the future – are understandably very interested in estimates of the future potential scale of displacement of pastoralists as a result of slow onset disasters such as drought. Unfortunately, several factors make such estimates highly uncertain. In our work to create the computer simulation we encountered those challenges as well, which means our simulator's estimates of the potential future scale of displacement are also highly uncertain. These challenges are described in more detail below.

There is scarce primary historical data available on pastoralist demographics and that which does exist is of relatively poor quality.[58]

> *The extent of this data-deficit on a continent-wide scale can be evaluated when we consider that Kenya, probably the country with the best demographic data in sub-Saharan Africa and many nomadic pastoralist populations, excluded the seven northern districts (where most Kenyan pastoralists apart from the Maasai live) from all DHS surveys until 2000.*[59]

In Somalia, a population estimated provided by the UN Development Programme in 2005 was the first published since the start of the armed conflict in 1991. More recently, the AfriPop project has been combining satellite imagery analysis with extrapolations from demographic trend data to produce an updated population estimate.[60]

The nomadic way of life of pastoralists and the fact that even in non-drought conditions populations live in remote areas and move across national boundaries, mean that accurate baseline estimates of populations of pastoralists in Somalia, Kenya, and Ethiopia have been difficult to determine. It has been difficult, for example, to estimate what fraction of 'rural' population in different countries or provinces are pastoralists. It is similarly difficult to estimate birth and death rates under baseline conditions. Additionally, different sub-national and national governments may use different methods and frequencies for collecting demographic data, making it difficult to unite datasets from different parts of the region into a single, internally consistent picture. Historical datasets are also hard to use because administrative boundaries have changed in many of the regions included in this study.

58 Sara Randall, 2008. "African Pastoralist Demography." In Homewood, K. (ed.) *Ecology of African Pastoralist Societies* pp. 200–225.

59 *Ibid.,* p.202.

60 Robinson, C., Zimmerman, L., and Checchi, F., 2014, *Internal and external displacement among populations of southern and central Somalia affected by severe food insecurity and famine during 2010-2012.* FEWS NET. http://goo.gl/fWThsk.

Like pastoralists who herd them, the number of livestock in the pastoralist system in the Horn of Africa is highly uncertain. Their mobility makes estimation difficult, and a cultural reluctance to divulge herd size may further obscure the data.[61] Because loss of livestock is a key driver of displacement in the simulation, the incomplete data on historical livestock populations, both under normal and drought conditions, has posed a challenge for the modelling.

The common way to reduce the amount of uncertainty of estimates produced by simulation models is to use historical data to calibrate the model. Unfortunately, determining the number of pastoralists who have been displaced, either internally or across borders by recorded droughts, has also been extremely challenging. Most records from IDP and refugee camps do not distinguish pastoralists from farmers, nor do they accurately reflect whether people were forced to flee due to the impacts of a drought or other causes, such as conflict. As a result, one of the typical ways to bolster confidence in estimates produced by computer simulations – comparing model results with historical data – has been difficult. The one published study of displacement in the region during the 2010–2011 drought, which focused on cross-border displacement from and internal displacement within Somalia, relied on the same data from the UN Refugee Agency (UNHCR) we used to calibrate our simulator.[62]

In addition to uncertainty about baseline trends and the strength of drivers of displacement it is also difficult to predict future conditions in the region. For example, the level of future climate change is unknown and depends on effects outside the region. The influence of global climate change on local and regional rainfall patterns is also uncertain.

Future population trends and trends of urbanisation also add uncertainty. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) states that "[m]ajor extreme weather events have in the past led to significant population displacement," and that "changes in the incidence of extreme events will amplify the challenges and risks of such displacement. Many vulnerable groups do not have the resources to be able to migrate to avoid the impacts of floods, storms and droughts."[63] Based on "medium evidence" the IPCC identified a vicious cycle in which the negative impacts of climate change can increase the likelihood of future conflicts and that conflicts, in turn, can increase vulnerability to climate shocks.[64]

Our response to this uncertainty is to, instead, study future scenarios, or combinations of scenarios. It is important to remember that these scenarios are, in the case of displacement of pastoralists, a layer of uncertainty applied on top of uncertainty about current conditions and the relative strengths of driving factors. Thus uncertainty about the future compounds the already large uncertainty in this system.

VALIDATING THE MODEL AND BUILDING CONFIDENCE IN ITS RESULTS

A key component of the development of the Pastoralist Livelihood and Displacement Simulator was formalising the causal relationships and drivers of pastoralist dis placement. From a literature review, fieldwork, interviews and data collection, we have constructed a systems view of rainfall, pasture/grazing land, pastoralist economics and displacement (Figure A.2). Generally speaking, less rainfall because of more droughts causes a decline in pasture productivity. The availability of less fodder in turn increases livestock mortality which shrinks the livestock population. The displacement of pastoralists increases during these periods when herd sizes reach the critical threshold necessary for subsistence, at which point pastoralists are (temporarily) unable to support their livelihoods.

Figure A.2 represents a high-level view of the key factors of the model, and how they can be influenced by natural and human factors. Each of these factors itself represents a smaller system whose behaviour is influenced by many factors (Figure A.3). The Pastoralist Livelihood and Displacement Simulator incorporates the dynamics of these subsystems and the way that they interact to influence livelihoods and the behaviour of the variable of primary interest: the displacement of pastoralists.

In order to build a model with all of these elements, we looked for data to define the following important relationships in the pastoralist system:

- between rainfall and displacement
- between rainfall and livestock population
- between livestock populations/livelihoods and displacement.

While we found data and reports shedding light on all three relationships, only the first two have high quality data at this point in our research. In particular, the

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61 Randall (*op. cit.*) notes that ethnic-minority pastoralists have been reluctant to divulge information about household size and livestock holdings due to a fear that this information could be used to reduce aid and/or increase taxes.

62 Robinson *et al., op. cit.*

63 Adger, W. N., Pulhin, J., Barnett, J., Dabelko, G.D., Hovelsrud, G.K., Levy, M., Oswald Spring, U., and Vogel, C. 2014. "Chapter 12. Human Security." In *Climate Change 2014: Impacts, Adaptation, and Vulnerability IPCC Working Group II Contribution to AR5,* Cambridge University Press, p.2. http://goo.gl/ljinuu.

64 *Ibid,* p.3.

Figure A.2: High-level diagram of pastoralist displacement dynamics

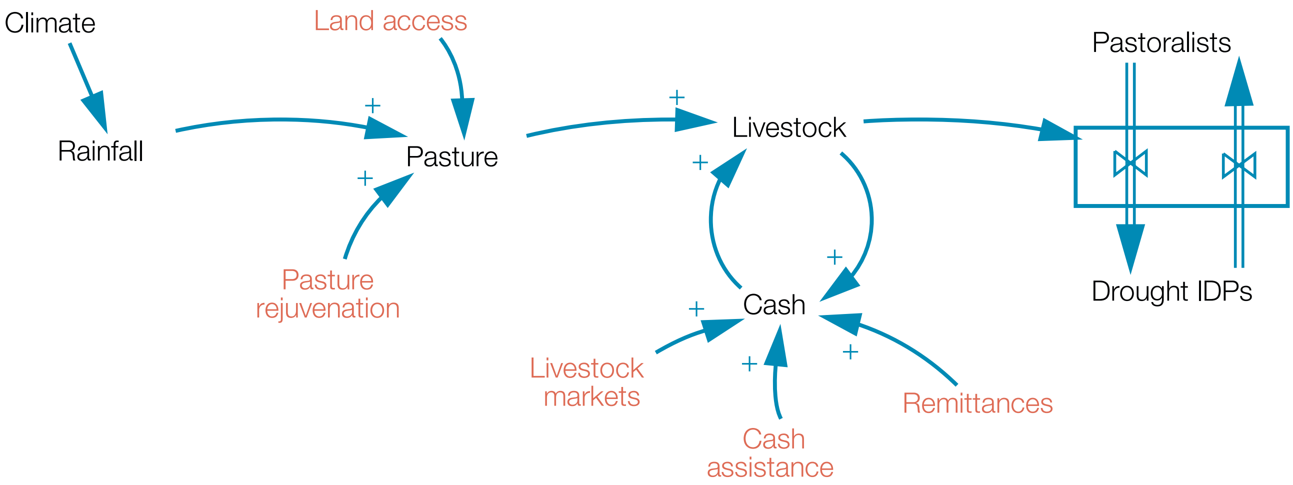
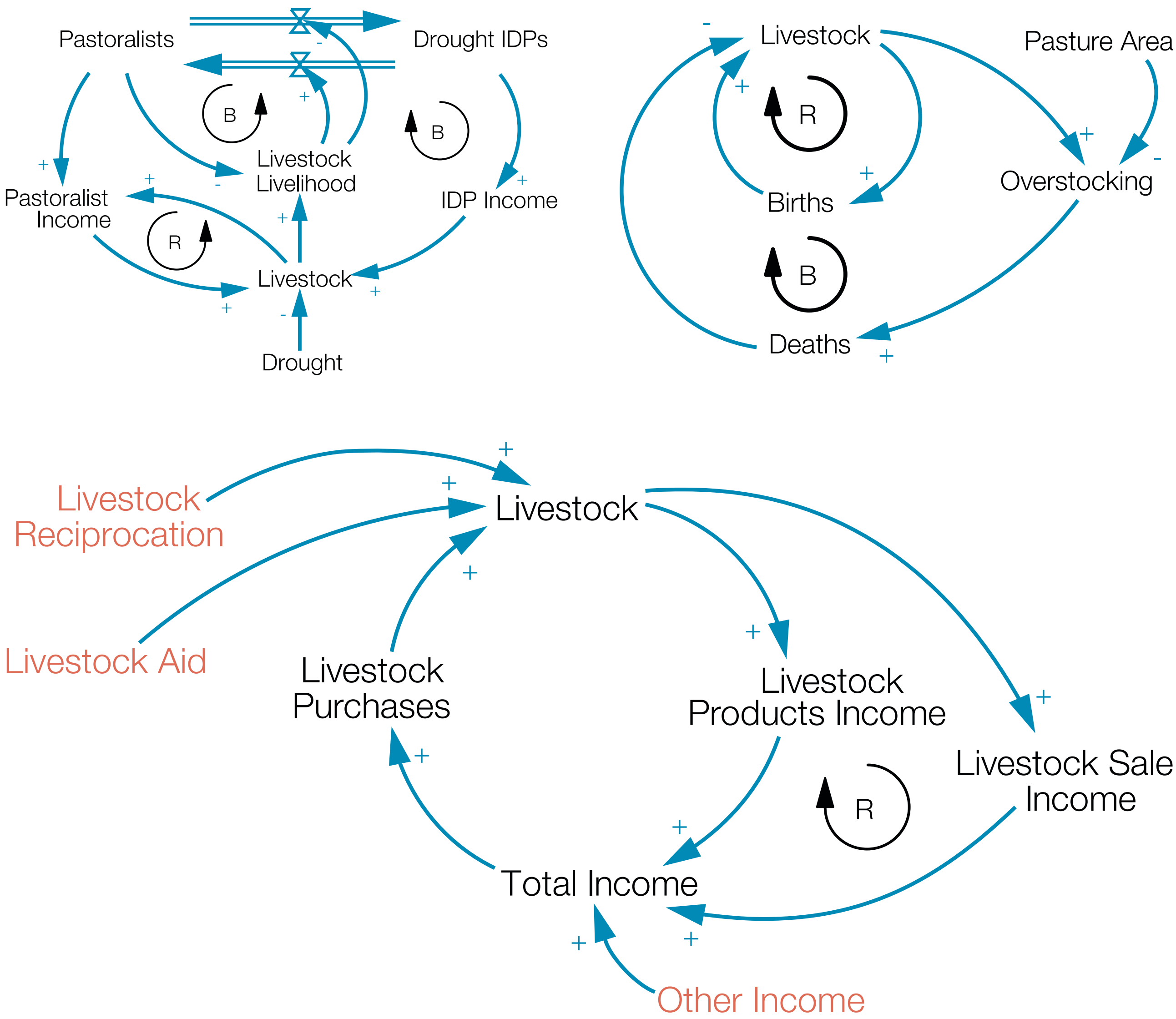


Figure A.3: Key 'sub-systems' within the system dynamics model



strength and shape of the relationship between livestock and displacement involves the social norms and preferences of pastoralists. These diagrams illustrate how herd size influences livelihoods and displacement: when a pastoralist's livestock holdings increase, household income goes up and food security improves and pastoralism continues to be a viable option. However, when a drought decimates a herd, it reduces pastoralist incomes, creates food insecurity and undermines the sustainability of pastoralism. When the herd reaches the threshold at which point pastoralism is no longer viable in terms of income and food security, pastoralists become displaced.

Figure A.3 also reveals how rain-fed grazing lands are in a state of dynamic (rather than static) equilibrium: as livestock produce more livestock they may eventually approach and even surpass the carrying capacity of accessible pasture areas at that point in time. When this occurs, pastoralists must sell their animals to reduce the pressure on their grazing areas. If they do not do so the herd will shrink naturally as livestock mortality increases and live births decrease.

Figure A.3 illustrates how having some livestock helps pastoralists increase their herd size in two ways. First, the more animals one has the faster the herd will growth via the birth of new livestock. Second, as the size of one's herd grows and income from the sale of milk and other livestock products increases, one will have more cash with which to purchase still more animals. Due to the same factors, rebuilding the herd becomes increasingly difficult and time consuming once the size of one's herd falls below the subsistence threshold. At this point, interventions like food assistance and access to credit or breed stock can facilitate herd rebuilding. We have found case studies that qualitatively capture various parts of these norms and preferences, but we have not yet found rigorous quantitative surveys and analysis.

Using the data that we did find on the first two relationships, we were able to build confidence in the model. In particular, the model is able to produce patterns that resemble trends seen in data from the region.

To test whether the model generates realistic declines in livestock numbers in response to drought, and with realistic timing, it would be ideal to turn to datasets on livestock population. Unfortunately, we have found such data difficult to uncover. Humanitarian assessments during droughts often report the impact of the drought on livestock populations. They are difficult to interpret because it is hard to discern which populations they are talking about (i.e., pastoralists, agro-pastoralist or everybody), the geographic scale of the livestock decline and time frame over which the decline occurred. Some reports say the 1995 drought caused a 70–80 per cent decline in livestock populations in the Horn of Africa without specifying where within the region the decline took place or the base year against which it was measured. Although better data about the impact of drought on livestock populations has been hard to uncover we find, within the limits of existing data, that the model generates realistic livestock declines in response to historical rainfall patterns.

We collected a variety of anecdotal evidence about the impact of drought on livestock populations (Table A.1). We compared the model's livestock population results to the collected historical field reports. We found the model output fits well for some historical droughts (for example in the early 2000s) but less well for others (Figure A.4). The simulated livestock population of north-eastern Kenya did not decline as much as reports described during the mid-1990s drought. One reason for the discrepancy could be that the drought was more extreme elsewhere in the Horn and the report of a 29 per cent decline of cattle was for the entire Horn, not just Kenya where declines could have been less severe). The next two reports stated livestock declines in "Kenya", though not necessarily Garissa, Mandera, Marsabit or Wajir. The model output had a good fit with the historical data we found for the 2001 drought – the modelled livestock population declined by the reported 30 per cent (of the assumed pre-drought peak). The model behaviour in the mid-2000s drought is reasonable, although the modelled livestock population declined less than was reported in the historical evidence we found.

Table A.1: Recorded drought impacts on livestock

Drought Year(s)	Location	Drought Impact
1991 – 1992	Northern Kenya	70% loss of livestock
1991 – 1993	Ethiopia (Borana Plateau)	42% loss of cattle
1995 – 1997	Greater Horn of Africa	29% loss of cattle; 25% loss of sheep and goats ('shoats')
1995 – 1997	Southern Ethiopia	78% loss of cattle; 83% loss of shoats
1998 – 1999	Ethiopia (Borana Plateau)	62% loss of cattle
1999 – 2001	Kenya	30% loss of cattle; 30% loss of shoats; 18% loss of camel
2002	Ethiopia (Afar and Somali)	40% loss of cattle: 10-15% loss of shoats
2004 – 2006	Kenya	70% loss of livestock in some pastoral communities
2005	Kenya (Mandera and Marsabit)	30-40% loss of cattle and shoats; 10-15% loss of camels
12/2005 – 3/2006	Kenya	40% of cattle, 27% of sheep, 17% of goats, killed 40 people
2010 (May)	Somalia	70-80% livestock lost

Figure A.4: Modelled versus recorded drought impacts on livestock mortality

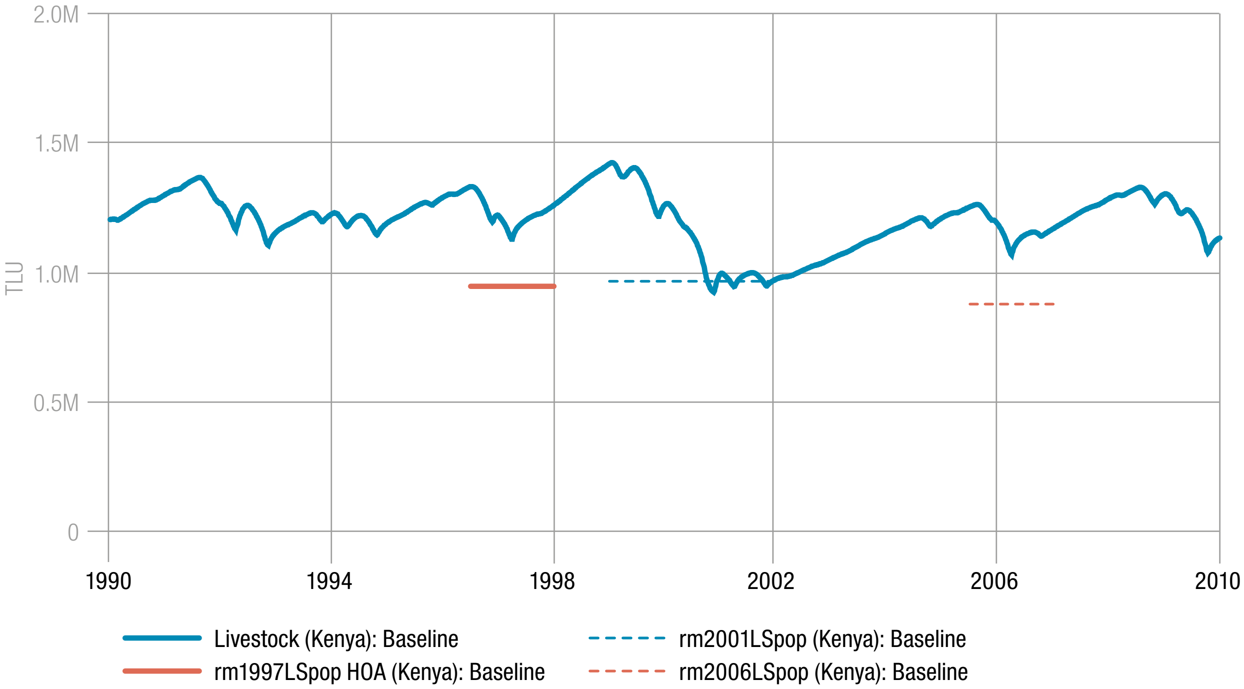


Figure A.5: Recorded rainfall and displacement in Somalia (2008–2013)

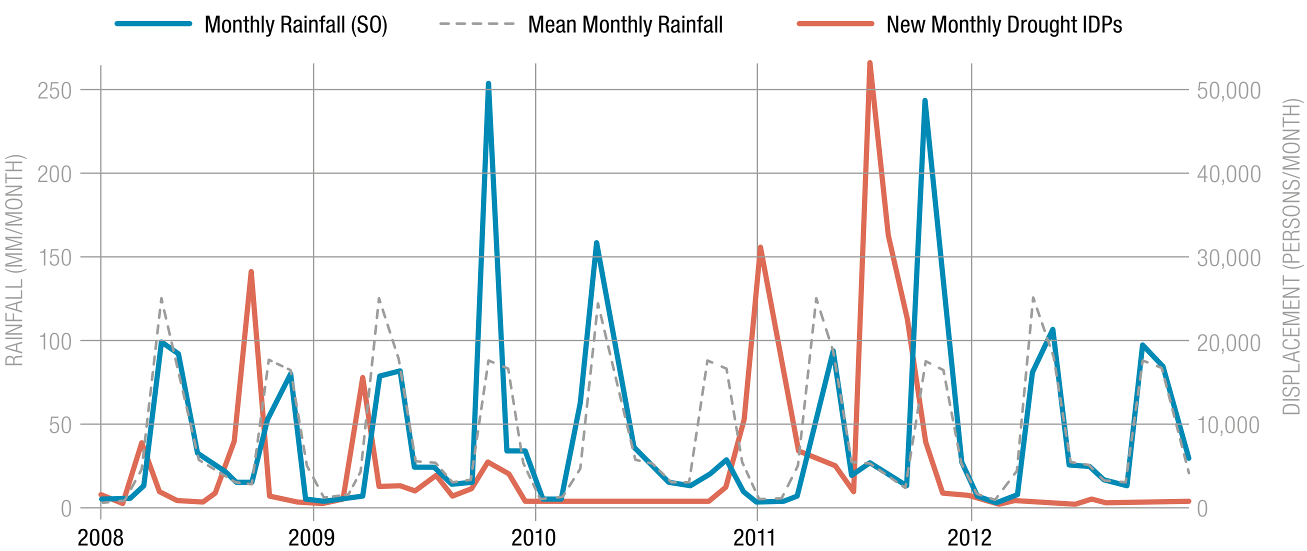


Figure A.5 compares actual monthly rainfall in southern Somalia with the national monthly displacement[65] in Somalia due to 'drought', as reported by UNHCR. The mean average rainfall of southern Somalia is also plotted so it is easy to compare when rainfall is above or below normal.

The data indicates that:

1. Displacement is delayed relative to reductions in rainfall. Displacement does not occur immediately when the rains fail but, instead, the flow of IDPs increases after a delay of several months
2. Displacement can occur even if rainfall is close to the mean rainfall. People can be displaced by drought even when the actual rainfall is close the historical average (e.g., the first part of 2009)
3. The flow of newly displaced persons, declaring 'drought' as their reason for displacement, declines quickly when rains come. People stop becoming displaced because of drought when rains provide the water needed for their livelihoods. Importantly, this does not necessarily mean that total number of drought-displaced IDPs declines. Instead, it means that there are no new drought-displaced IDPs requiring assistance.

A model of drought displacement should be able to reproduce similar behaviour to Figure A.5 for a similar pattern of rainfall. Figure A.6 shows the model results when the model is driven by historical rainfall in the two bordering regions of the model: southern Somalia and north-eastern Kenya. The simulated behaviour reproduces the patterns seen in the historical data:

- displacement is delayed and typical occurs several months after an expected rainy season
- displacement can occur when rainfall is close to the historical mean displacement flow drops significantly and quickly when a new rainy season begins.

While the model results for Somalia replicate the pattern of behaviour seen in the historical data, the model output does not exactly match the UNHCR displacement data for several reasons. The UNHCR data is for all of Somalia and all Somalis, not just pastoralists in southern Somalia, whereas the model is specific for pastoralists. This explains why the scale of displacement is higher in the UNHCR data as compared to the simulated output. Additionally, UNHCR data does not disaggregate pastoralists from agriculturalists who might be more strongly affected by drought than pastoralists because they are not able to move their crops to 'greener pastures'. If agriculturists are more sensitive to drought than pastoralists there could be some displacement episodes in the UNHCR dataset that are not seen in the pastoralist-specific model output.

FURTHER WORK TO IMPROVE THE DROUGHT-RELATED DISPLACEMENT MODEL

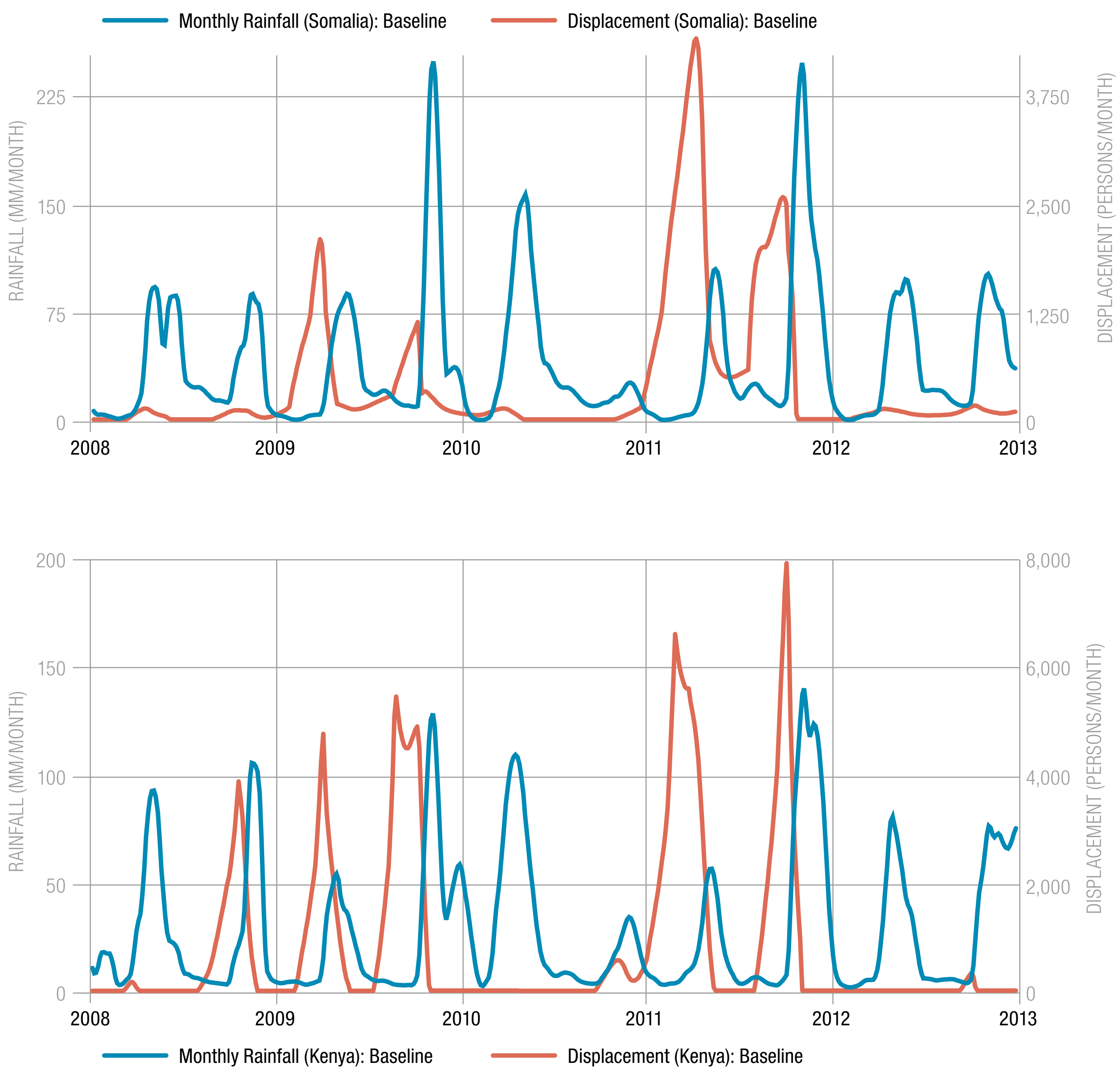
The development of the Pastoralist Livelihood and Displacement Simulator represents a first step in IDMC's efforts to monitor and analyse drought-related displacement. At present, it is an evidence-based tool for understanding the environmental and human drivers of displacement of pastoralists. There are several ways that the simulator could be improved , especially if it were to be used to inform decision-making and early warning/ early action.

The modelling process has revealed several data gaps that currently add to the uncertainty of the simulations. More reliable time series data about pastoralist and livestock populations are needed to calibrate and build confidence in the simulator. Initiatives such as the AfriPop Project and potentially new sources of data (e.g., from human and livestock vaccination programmes) may help fill some of these gaps.

Social phenomenon, like urbanisation, changes in family structure and education patterns and decisions of when and how to move are important to understanding trends in future displacement. Determining some of the strengths of these effects may require carefully designed field studies and additional interviews with pastoralists and displaced pastoralists.

65 http://goo.gl/poQvng

Figure A.6: Historical rainfall and modelled displacement in Somalia and Kenya



DISASTERS
CLIMATE CHANGE AND
DISPLACEMENT

EVIDENCE FOR ACTION

This is a multi-partner project funded by the European Commission (EC) whose overall aim is to address a legal gap regarding cross-border displacement in the context of disasters. The project brings together the expertise of three distinct partners (UNHCR, NRC/IDMC and the Nansen Initiative) seeking to:

1 › **increase the understanding** of States and relevant actors in the international community about displacement related to disasters and climate change;

2 › **equip them to plan for and manage** internal relocations of populations in a protection sensitive manner; and

3 › **provide States and other relevant actors tools and guidance** to protect persons who cross international borders owing to disasters, including those linked to climate change.

iDMC internal displacement monitoring centre